3. INITIAL OU 3-13 EVALUATION

An evaluation of the work performed in the Operable Unit (OU) 3-13 Remedial Investigation/ Feasibility Study (RI/FS) (DOE-ID 1997a) and presented in the OU 3-13 Record of Decision (ROD) (DOE-ID 1999a) is summarized in this section for the sites being addressed under OU 3-14. The information presented here concerning the OU 3-14 release sites is included for informational purposes only. The information summarizes current understanding of the conditions at these sites based on past characterization and process knowledge and provides the foundation for the OU 3-14 Work Plan rationale presented in Section 4. Following additional site characterization, screening of remedial alternatives will be presented in a separate RI/FS that is consistent with the initial phased remedies presented in the OU 3-13 ROD (DOE-ID 1999a).

The operational history of the Tank Farm, the former Idaho Nuclear Technology and Engineering Center (INTEC) injection well, and OU 3-14 background and the physical setting are presented in Section 2. Specific information supporting the history of the Tank Farm is presented in Appendices A through F.

3.1 Description of OU 3-14 Sites

This section covers the description of the OU 3-14 sites, the sources of contamination at each site, and based on past investigations (DOE-ID 1997a), contaminants that are likely to adversely affect human health and the environment through the surface soil or groundwater pathways. These sites were either assigned to OU 3-14 in the OU 3-13 ROD (DOE-ID 1999a) or defined in the OU 3-14 Scope of Work (SOW) (DOE-ID 1999b). OU 3-14 comprises the following sites:

- Tank Farm soil sites, all of which are consolidated in site CPP-96. Specifically, CPP-96 is a consolidation of sites CPP-15, CPP-16, CPP-20, CPP-24, CPP-25, CPP-26, CPP-27, CPP-28, CPP-30, CPP-31, CPP-32, CP-33, CPP-58, CPP-79, and CPP-96.

- Site CPP-23, the INTEC injection well, and aquifer within the INTEC security fence.

- Additional soil sites from OU 3-13, sites CPP-61, CPP-81, and CPP-82.

Previous investigation into the Waste Area Group (WAG) 3 sites by the OU 3-13 Remedial Investigation/Baseline Risk Assessment (RI/BRA) (DOE-ID 1997a) determined which sites have contamination at levels likely to adversely affect human health and the environment. The OU 3-13 baseline risk assessment (BRA) evaluated the nature and extent of contamination, contaminant fate and transport, and risks associated with available and estimated site-related contamination data for the WAG 3 release sites. The site screening determined which sites to eliminate from further evaluation, based on acceptable levels of residual contamination. Thus, only those sites with contamination above acceptable limits were carried over. Contaminant screening was performed on the carried-over sites (see Table 7-1, DOE 1999a). Table 3-1 presents the results of the OU 3-13 site and chemical screening process for the sites being addressed under OU 3-14. The characterization uncertainties associated with the OU 3-14 sites are summarized in the text and at the end of each site's descriptive summary. The uncertainties drawn from the OU 3-13 RI/BRA (DOE-ID 1997a) are summarized in Section 3.3.

Table 3-1. Results of the OU 3-13 site and chemical screening process. (Adapted from Table 7-1 in the OU 3-13 ROD).

Site Description (OU 3-13 sites being addressed under OU 3-14)	Retained OU 3-13 Contaminants
Tank Farm soil	
CPP-15 Solvent burner east of building CPP-605, radiological contamination	Thallium[a] zirconium[a] Am-241 Cs-137 Eu-154 Np-237 Pu-238 Pu-239/240 Tc-99 U-235
CPP-16 Contaminated soil from leak in line from tank WM-181 to PEW evaporator	Not evaluated[b] Contaminants estimated to be present include Cs-137, Sr-90, U, and Pu isotopes, and some inorganic constituents (WINCO 1991).
CPP-20 Building CPP-604 radioactive waste unloading area	arsenic[c] Am-241 Cs-134 Cs-137 Cobalt-60 Eu-154 Np-237 Pu-238 Sr-90 Tc-99
CPP-24 Bucket spill near tank WM-180 riser	Not evaluated[b] Liquid would have contained mercuric nitrate, nitric acid, and radionuclides (WINCO 1993)
CPP-25 Contaminated soil in the Tank Farm, north of building CPP-604	arsenic[c] Am-241 Cs-134 Cs-137 Co-60 Eu-154 Np-237 Pu-238 Sr-90 Tc-99

Table 3-1. (continued)

Site Description (OU 3-13 sites being addressed under OU 3-14)	Retained OU 3-13 Contaminants
CPP-26 Contaminated soil in the Tank Farm area, steam flushing operation inside the Tank Farm perimeter, near tank WM-188	Am-241 Cs-137 Eu-154 Pu-238 Pu-239 Sr-90 U-234 U-235
CPP-27 Contaminated soil in the Tank Farm area, east of building CPP-604 and site CPP-33	Arsenic[i] chromium[h] Am-241 Cs-137 Eu-154 Np-237 Pu-238 Pu-239/240 Sr-90 U-235
CPP-28 Contaminated soil in the Tank Farm area, south of tank WM-181 by valve box A-6	Ce-144 Cs-134 Cs-137 Co-60 Eu-154 H-3 Np-237 Pu-239 Pu-240 Pu-241 Pu-242 Ru-106 Sr-90 U-234 U-235 U-236
CPP-30 Contaminated soil near valve box B-9 in the vicinity of tanks WM-187 and WM-188	Not evaluated[b]
CPP-31 Contaminated soil in the Tank Farm, south of tank WM-183	Cs-134 Cs-137 Co-60 Eu-154 Pu-239/240 Ru-106 Sr-90 U-235

Table 3-1. (continued)

Site Description (OU 3-13 sites being addressed under OU 3-14)	Retained OU 3-13 Contaminants
CPP-32 West and East Contaminated soil in the Tank Farm in area near tank WM-186 valve box B-4	Cs-137 Eu-154 Sr-90
CPP-33 Contaminated soil in the Tank Farm, northeast of building CPP-604	Arsenic chromium[h] Am-241 Cs-137 Np-237 Pu-238 Pu-239/240 Sr-90 U-235[j]
CPP-58 West and East Subsurface release of contaminants associated with PEW spills and PEW evaporator overhead pipeline spills	Am-241 Cs-137 Eu-154 Pu-238 Pu-239 Sr-90 U-235
CPP-79 Tank Farm release near valve box A-2, south of tank WM-181	Am-241 Cs-137 Pu-238 Pu-239[d] Sr-90 U-234 U-235
CPP-96 Site CPP-96 encompasses all of the above sites	Retained OU 3-13 contaminants listed for above mentioned sites and potentially others
Injection well	
CPP-23 Former injection well, northwest of building CPP-666	Cs-137 Eu-152 Eu-154 Sr-90
Additional soil sites from OU 3-13	
CPP-61 PCB spill in CPP-718 transformer yard, radiological contamination	PCB[e] Cs-137 Sr-90 Tc-99

Table 3-1. (continued)

Site Description (OU 3-13 sites being addressed under OU 3-14)	Retained OU 3-13 Contaminants
CPP-81 Abandoned VOG line for buildings CPP-637/CPP-601	Not evaluated[f]
CPP-82 Abandoned underground line (PLA-776) west of Beech Street	Not evaluated[g]

NOTE: Contaminants listed are the retained Ou 3-13 contaminants from the contaminant screening process in the OU 3-13 RI/BRA unless a site was not evaluated, see specific footnote.

a. No toxicity value is available.

b. A Track 2, No further action site (WINCO 1993d; DOE-ID 1997a).

c. The OU 3-13 RI/BRA, Section 10.1.2, includes arsenic as a retained OU 3-13 contaminant.

d. The OU 3-13 RI/BRA, Section 10.7.2, includes Pu-239 as a retained OU 3-13 contaminant.

e. A Track 1 Investigation, No further action site for contaminant PCB (WINCO 1992a; DOE-ID 1997a).

f. A Track 1 Investigation, No further action site (WINCO 1994b; DOE-ID 1997a).

g. A Track 1 Investigation, No further action site (WINCO 1992b; DOE-ID 1997a).

h. Chromium was not included as part of the source estimate for Tank Farm surface soil because it was eliminated in the screening process for OU 3-08 (DOE-ID 1997a, Section 11). Chromium is part of the source estimate for future groundwater usage because given enough time, chromium will reach the SRPA. (DOE-ID 1997a, Sections 16 and 29).

i. The OU 3-13 RI/BRA, Section 11.2.2 includes arsenic as a retained OU 3-13 contaminant.

j. The OU 3-13 RI/BRA, Section 11.2.2 includes U-235 as a retained OU 3-13 contaminant for site CPP-33. However, Table 5-31 of the OU 3-13 RI/BRA does not include U-235 as a retained OU 3-13 contaminant for site CPP-33.

The contaminants identified in the OU 3-13 RI/BRA for the Tank Farm soil and injection well and aquifer within the INTEC security fence were not inclusive of all those potentially present. The inability to sample each site and incomplete evaluation of the collected samples for the full range of potential contaminants (e.g., radionuclides and metals) left uncertainty in the source term for these sites. This source term uncertainty, along with other geophysical uncertainties, was carried forward into (1) the site and contaminant screening process, performed in the OU 3-13 RI/BRA, which generated a list of retained OU 3-13 COPCs (see Table 5-51 in the OU 3-13 RI/BRA) for quantitative evaluation in the OU 3-13 RI/BRA, and (2) the resulting OU 3-13 COCs for the OU 3-13 Tank Farm soil (see Section 3.2.1) and the aquifer beneath INTEC (see Section 3.2.2).

The retained OU 3-13 contaminants listed in Table 3-1 represent the preliminary identification of OU 3-14 analytes of concern. These OU 3-13 COPCs, retained from the chemical screening process performed in the OU 3-13 RI/BRA or as indicated, are the contaminants determined from historical process or environmental release information on a given site. These are only preliminary OU 3-14 analytes of concern to sample for because all of the contaminants have not been identified at the sites.

The OU 3-14 RI/FS provides the means to collect data for the Tank Farm soil, injection well, and aquifer beneath INTEC to determine the complete list of contaminants present, their screening to retained OU 3-14 COPCs, and subsequently, the determination of OU 3-14 COCs. This will fill the data gap identified in the OU 3-13 ROD to enable making a final remediation decision for the OU 3-14 sites. In addition to the retained OU 3-14 COPCs, all analytes detected and soil parameters should be considered in the OU 3-14 FS to the extent they may affect the effectiveness of potential process options.

3.1.1 Tank Farm Soil Contaminant Sources

The Tank Farm known soil contamination sites are shown in Figure 3-1. The individual site descriptions are primarily a composite of the information contained in the OU 3-13 RI/BRA (DOE-ID 1997a), the OU 3-13 Feasibility Study (FS) (DOE-ID 1997b), and the FS Supplement (DOE-ID 1998a). The generating process, release mechanism, and artifacts are discussed to provide a better understanding of the processes that produced the contamination in Tank Farm soil.

The contaminant sources in Tank Farm soil resulted from past spills, leaks, and contaminated backfill. Spills have occurred during waste handling and maintenance operations at the Tank Farm. Spills tend to be better characterized than leaks in terms of timeframe, volume, and characteristics using process knowledge information. Leaks include the sites in which the release occurred in the subsurface over time. Most leaks are from pipes that have become corroded. When the releases began or how much volume was released is not generally known. Contaminated backfill was used during Tank Farm maintenance and contamination removal activities. Typical materials used to backfill Tank Farm excavations consisted of soil contaminated with radioactivity at levels of 3–5 mR/hour. This soil was placed in the bottom of excavated areas and clean soil was placed on top for shielding purposes.

3.1.1.1 Site CPP-15. Site CPP-15 was the location of the solvent burner building (CPP-629) (Figure 3-1). Operation of the facility began in the late 1950s. The facility was dismantled in 1983. The spent organic solvent, either hexone (methyl isobutyl ketone [MIBK]) or tributyl phosphate (TBP) and purified kerosene, burned in the building, came from the uranium solvent extraction processes. Solvent extraction was used to separate uranium from fission products. The solvent was put in contact with uranium, contained in an aqueous solution of uranyl nitrate that was produced in the fuel dissolution process.

The spent solvent was burned in a standard furnace oil burner in a fire-brick lined enclosure, fed by an underground solvent feed tank (LE-102) located below the building. The furnace off-gases were sent unfiltered to the INTEC main stack. During operations, the burner flue routinely leaked combustion products, resulting in contamination in the area east of building CPP-629. A 1977 analysis of soot taken from the flue detected I-129 (6.67E-02 pCi/g), Pu-239 (3.85E-00 pCi/g), Am-241 (6.25E-02 pCi/g), Cs-137 (1.32E+01 pCi/g), Ba-137m (2.94E-02 pCi/g) and Ru-106 (3.38E+01 pCi/g).

On March 28, 1974, during maintenance of the solvent burner, liquid was reportedly found on the ground inside and outside the solvent burner building (CPP-629). A leak of the spent solvent was determined to have occurred from the ground surface flange directly above the solvent feed tank. The quantity of spilled liquid is unknown. It was reported that beta and gamma radiation readings as high as 3 R/hour were detected in the contaminated soil outside the building, which was removed and placed in drums. Uncontaminated soil was used to backfill the excavation.

The Solvent Burner Building was demolished in 1983. The demolition included removal of the furnace/burner unit, furnace duct, control shed, piping, valves, and controls within the shed, piping penetrating the shed, the solvent feed tank (LE-102), and contaminated soil in the area. Interviews with personnel involved in the demolition indicated that the soil excavation exceeded 10 ft below grade and was very thorough. No post excavation sampling was performed to confirm the removal of contamination. Site CPP-15 was originally included in OU 3-08, which underwent a Track 2 Investigation (WINCO 1993b). The Track 2 investigation was performed on the basis of information about the demolition and removal activities. No sampling and analysis were performed. Site CPP-15 was recommended for no further action.

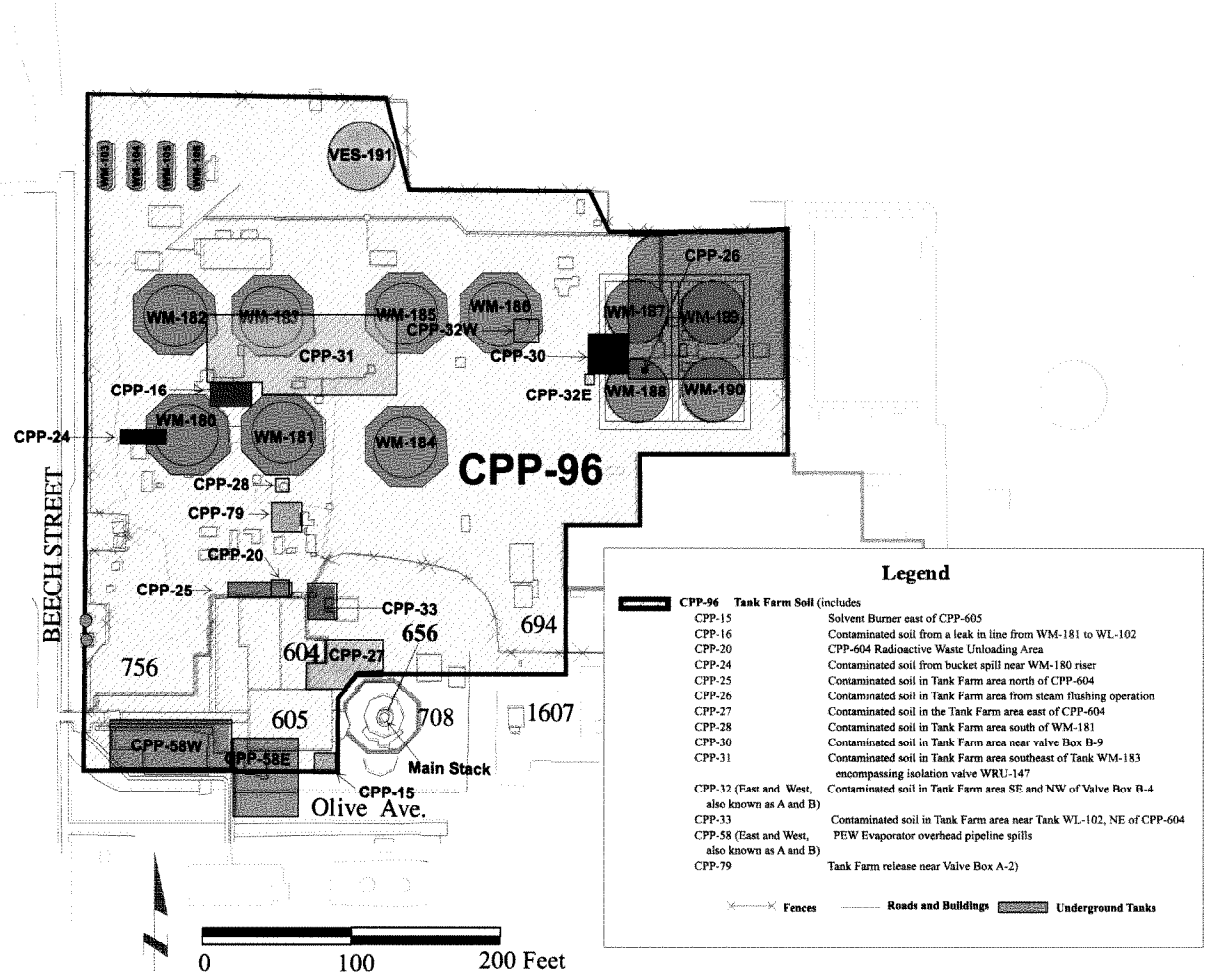


Figure 3-1. Known Tank Farm soil contamination sites.

In September 1995, construction personnel encountered elevated radiological readings while excavating soil in the western portion of the CPP-15 site. The excavation was in support of installation of an electrical duct bank and transformer pad. The contaminated soil was encountered at a depth of 0.6 m (2 ft). Beneath the contaminated soil was a concrete footing with a hot spot reading of 1.5 R/hour. The footing was a remnant of the old stack pre-heater. Six soil samples were collected in the area of the contaminated footing from the following five locations:

- A stockpile of excavated soil in a dump truck (Sample CPP-15-1)
- Soil approximately 0.46 m (1.5 ft) away from the footing, 0.61 m (2 ft) bgs (Sample CPP-15-2)
- Soil directly below the footing (Samples CPP-15-3 and CPP-15-5)
- Soil 1.2 m (4 ft) below the footing (Sample CPP-15-4)
- Soil 2.6 m (8.5 ft) below the footing (Sample CPP-15-6).

3.1.1.1.1 Data Review—The results of the analyses indicate that the highest levels of radionuclide contamination were present in the samples collected 2.6 m (8.5 ft) below the contaminated footer and 3.2 m (10.5 ft) belowgrade. This would suggest that not all of the contaminated soil was removed during the 1983 demolition activities and is consistent with the report that the excavation extended only to 3 m (10 ft) belowgrade. Cesium (Cs)-137 was the only radionuclide detected in the four shallow soil samples during an analysis for gamma-emitting radionuclides. The detected concentrations ranged from 2,350±120 to 43,300±1,800 pCi/g. In addition to gamma spectroscopy analysis, the sample from 3.2 m (10.5 ft) belowgrade was analyzed for a suite of other radionuclides including I-129, Np-237, total strontium, Tc-99, and plutonium and uranium isotopes. The Cs-137 activity in the sample was 586,000±170,000 pCi/g. Other radionuclides detected in the sample were Am-241 at 538±35 pCi/g, Eu-154 at 243±24 pCi/g, Np-237 at 0.63 pCi/g, Pu-238 at 4570±320 pCi/g, Pu-239/240 at 825±63 pCi/g, Tc-99 at 36.7 pCi/g, and U-235 at 0.0203 pCi/g.

All of the soil samples were subjected to analysis for metals, cyanide, sodium, potassium, semivolatile organic compounds (SVOCs), percent solids, and volatile organic compounds (VOCs) as well. Zirconium was detected in all six samples at concentrations ranging from 5.13 to 13.97 mg/kg. Thallium was detected in the sample at 4.85 mg/kg from 3.2 m (10.5 ft) belowgrade. The reported results for all other metals in the samples were consistent with background soil concentrations of the metals at the Idaho National Engineering and Environmental Laboratory (INEEL). In the organic analysis, methylene chloride was detected in all of the samples at very low concentrations (less than 0.01 mg/kg). It also was detected in the method blanks. Trichloroethene was detected in the sample of soil from the dump truck at an estimated concentration of 4.6 µg/kg.

The SVOC analysis of the soil samples indicates the presence of a number of SVOCs that would be expected at the site, given the site history, including tributyl phosphate and some polyaromatic hydrocarbons, which are associated with combustion of kerosene. The detected compounds include tri-n-butyl phosphate, acenaphthene, phenanthrene, anthracene, fluoranthene, benzo(k)fluoranthene, and benzo(b)fluoranthane. The analysis indicated that the compounds are spectrally present but at concentrations below the sample quantitation limit. The "U" flagged sample quantitation limits, called the method detectable limit (MDL) on the data reports, are what was reported for the compound concentrations in the data packages. Also detected in many of the samples were 3-nitroaniline, azobenzene, 2-methylphenol, bis(2-chlorethyl)ether, 2,6-dinitrotoluene, and numerous tentatively identified compounds. A number of other compounds including naphthalene, 2-methylnaphathalene,

2-chloronaphthalene, acenaphthylene, dimethylphthalate, dibenzofuran, fluorene, diethylphthalate, carbazole, di-n-butylphthalate, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, and di-n-octylphthalate were reported present in both the samples and the reagent blank.

3.1.1.1.2 Contaminant Summary—Based on the contaminant screening in the OU 3-13 RI/BRA, the retained OU 3-13 contaminants for this site are thallium, zirconium, Am-241, Cs-137, Eu-154, Np-237, Pu-238, Pu-239/240, Tc-99, and U-235 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil.

3.1.1.1.3 Characterization Uncertainty—The characterization uncertainties with site CPP-15 are listed below:

- Site characterization (western portion is incomplete and eastern portion is uncharacterized)
- Radiation activity levels
- Quantity of spilled liquid
- Spatial extent of contamination
- Source term.

3.1.1.2 Site CPP-16 Description. Site CPP-16 (Figure 3-1) is the site of a leak that occurred January 16, 1976, through an open-bottom valve box during a routine transfer from tank WM-181 to Process Equipment Waste (PEW) tank WL-102. Wastewater steam during the transfer melted the Teflon flange gasket, allowing the leak to occur. The plastic liner to the valve box also melted. The leak of low-level contaminated service wastewater drained out the bottom of the valve box into the soil beneath the valve box, which was at a depth of 1.72 m (5 ft 8 in.) (WINCO 1976, 1991). The volume in Tank WM-181 before the attempted transfer was 337,659 L (89,200 gal) and after was 324,410 L (85,700 gal) (Ward 2000); therefore, no more than 13,249 L (3,500 gal) leaked onto the soil. The valve box was replaced on January 19, 1976, with a concrete bottom valve box and stainless steel liner that extends 2 m (6 ft 9 in.) below ground surface (bgs) as part of the ICPP radioactive waste system project. Specifics of what was encountered during the construction activities—that is, how much soil was removed, or how much remains—are not known. Site CPP-16 was originally included in OU 3-07, which underwent a Track 2 Investigation in 1992 (WINCO 1993d). The Track 2 was performed on the basis of the information available and CPP-16 was recommended for no further action (WINCO 1993d; DOE-ID 1994). Site CPP-16 is being reinvestigated because with the consolidation of all Tank Farm soil and sites within CPP-96, this site is subject to OU 3-14 RI/FS activities.

3.1.1.2.1 Data Review—Soil samples indicate the contamination did not penetrate the soil beneath the valve to depths greater than 0.9 m (3 ft). Therefore, the depth of contamination extends from 1.72 m (5 ft 8 in.) to 2.6 m (8 ft 8 in.). The amount of soil contaminated during the spill is estimated at 25 ft^3 containing 1.2 curies of Cs-137 from the 13,249 L (3,500 gal) released (WINCO 1991).

3.1.1.2.2 Contaminant Summary—From historical information, estimated contaminants are Cs-137, Sr-90, uranium and plutonium isotopes, and some inorganic constituents (WINCO 1991). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites.

3.1.1.2.3 Characterization Uncertainty—The characterization uncertainties with site CPP-16 are listed below:

- Site characterization
- Radiation activity levels
- Spatial extent of contamination
- Source term.

3.1.1.3 Site CPP-20 Description. Site CPP-20 is a location north of building CPP-604 (Figure 3-1) to which acidic (i.e., pH < 2) radioactive liquid waste from INEEL facilities was transported and unloaded via transfer hoses to an underground storage tank. The facility was used for this purpose until 1978. The waste was destined for treatment in the PEW evaporator. Small spills would occasionally occur through holes in the pressurized transfer line as waste was being unloaded, resulting in soil contamination. It has been reported that the spills were cleaned up as they occurred, but no records exist documenting the types, quantities, and locations of the spills or verifying the effectiveness of cleanup activities.

The entire CPP-20 area was excavated down to 12.2.m (40 ft) in 1982 as part of Phase 1 of the fuel processing facility upgrade project. Personnel involved in the project indicate that the first 3 m (10 ft) of the excavation were backfilled with soil contaminated with radionuclides at activities of 5 mR/hour or less. The source of the contaminated soil is unknown, but it is likely that it was from within the Tank Farm. The remaining 9.1 m (30 ft) of the excavation was reportedly backfilled with clean (i.e., not radiologically contaminated) soil. Portions of the area were excavated a second time as part of the fuel processing facility upgrade project in the 1983–84 timeframe. Reportedly the eastern portion of CPP-20 was excavated to a depth of 12.2 m (40 ft). At the location of valve box C-30, contaminated soil was encountered and removed. The first 3 m (10 ft) of the excavation were reportedly backfilled with radiologically contaminated soil with activities of 3 mR/hour or less and the remainder of the excavation backfilled with clean soil from Central Facilities Area (CFA).

Site CPP-20 was originally included in OU 3-07, which underwent a Track 2 investigation in 1992 (WINCO 1993d). On the basis of the information indicating contaminated soil had been removed from the site during the fuel processing facility upgrade project, the site was recommended for no further action, contingent on the evaluation of the contaminated backfill as part of the OU 3-13 BRA (DOE-ID 1997a). The site was evaluated as part of the OU 3-13 BRA, using analytical results obtained from the fuel processing facility upgrade project.

3.1.1.3.1 Data Review—No sampling and analysis of the contaminated backfill, reportedly present between 9.1 and 12.2 m (30 and 40 ft) belowgrade, has been performed. The sampling and analysis of other excavated Tank Farm soil as part of the fuel processing facility upgrade project was used in the OU 3-13 BRA evaluation. The maximum detected concentration of arsenic, 5.9 mg/kg, is just above the background level (5.8 mg/kg) found in INEEL surface soil. The radionuclides detected at the highest activities, Sr-90 and Cs-137, were analyzed at 330 ± 3 pCi/g and 114 ± 1 pCi/g, respectively. Other detected radionuclides had maximum activities no greater than 2.2 pCi/g (WINCO 1993d).

3.1.1.3.2 Contaminant Summary—Based on contaminant screening in the OU 3-13 RI/BRA evaluation, the retained OU 3-13 contaminants for CPP-20 are arsenic, Am-241, Cs-134, Cs-137, Co-60, Eu-154, Np-237, Pu-238, Sr-90, and Tc-99. (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.3.3 Characterization Uncertainty

The characterization uncertainties with site CPP-20 are listed below:

- Site characterization
- Radiation activity levels
- Quantity of spilled liquid
- Spatial extent and location of contamination
- Source term.

3.1.1.4 Site 24 Description. Site CPP-24 is a contaminated soil site in the Tank Farm area resulting from a 1954 accidental dumping of a bucket, approximately 3.8 L (1 gal), of liquid radioactive waste (400 mR/hr) while work was being conducted in the vicinity of a tank WM-180 riser (Figure 3-1) (WINCO 1993d). The spill covered a 0.9 x 1.8-m (3 x 6-ft) area. The liquid would have contained mercuric nitrate, nitric acid, and radionuclides. The contamination from the spill was reportedly cleaned up (logbooks indicate that the spilled material was removed) and documented in a radioactivity incident report. Though the exact location of this spill is not known, radiation surveys in the area revealed no radiation levels above background (WINCO 1993d; DOE-ID 1994).

This site was recommended in a Track 2 investigation as a no further action site because the source was documented as having been removed and any residual contamination would be addressed during the OU 3-13 RI/FS (WINCO 1993d). Site CPP-24 is being reinvestigated because with the consolidation of all Tank Farm soil and sites within CPP-96, this site is subject to OU 3-14 RI/FS activities.

3.1.1.4.1 Data Review— No known sampling has been done at site CPP-24, and based on historical information, the spilled liquid would have contained mercuric nitrate, nitric acid, and radionuclides. The specific contaminants are unknown.

3.1.1.4.2 Contaminant Summary—Based on historical information, the spilled liquid would have contained mercuric nitrate, nitric acid, and radionuclides. Section 3.1.4 summarizes the contaminants at the OU 3-14 sites.

3.1.1.4.3 Characterization Uncertainty—The characterization uncertainties with site CPP-24 are listed below:

- Site characterization
- Radiation activity levels
- Exact spill location
- Spatial extent of contamination (depth is unknown, surface area is historically reportedly as 0.9 × 1.8 m [3 × 6 ft])
- Source term.

3.1.1.5 Site CPP-25 Description. Site CPP-25 is located in the same general area as CPP-20 and overlaps the CPP-20 site on the eastern edge (Figure 3-1). It is the location of a ruptured transfer line that was being used to transfer liquid waste from tank WC-119 to the PEW evaporator feed tank (WL-102) (see Figure 2-15). The rupture resulted in a release of an unknown quantity of liquid waste adjacent to the north side of building CPP-604 in August 1960. Reportedly, at the time of the incident radiation readings in the contaminated soil ranged from 2 to 4 R/hour. Approximately 7 m^3 (9 yd^3) of soil was removed after the spill and the side of the building was washed to remove contamination. No records exist to verify the effectiveness of these cleanup activities.

As described for CPP-20, the area where CPP-25 is located was excavated during the 1981 and 1983–84 fuel processing facility upgrade project. The excavations were reportedly filled with clean fill in the upper 9.1 m (30 ft) and with 3–5 mR soil from 9.1 to 12.2 m (30 to 40 ft). Site CPP-25 underwent a Track 2 investigation in 1992 (WINCO 1993d). On the basis of the information indicating contaminated soil had been removed from the site during the fuel processing facility upgrade project, the site was recommended for no further action, contingent on the evaluation of the contaminated backfill as part of the OU 3-13 RI/FS.

3.1.1.5.1 Data Review—No known sampling has been done at site CPP-25.

3.1.1.5.2 Contaminant Summary—Site CPP-25 was evaluated as part of the OU 3-13 RI/BRA, using site CPP-20 analytical results obtained from the fuel processing facility upgrade project. The retained OU 3-13 contaminants for site CPP-20/CPP-25 from the contaminant screening process in the OU 3-13 RI/BRA are arsenic, Am-241, Cs-134, Cs-137, Co-60, Eu-154, Np-237, Pu-238, Sr-90, and Tc-99 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.5.3 Characterization Uncertainty—The characterization uncertainties with site CPP-25 are listed below:

- Site characterization
- Radiation activity levels
- Quantity of spilled liquid
- Spatial extent of contamination
- Source term.

3.1.1.6 Site CPP-26 Description. Site CPP-26 (Figure 3-1) consists of soil potentially contaminated by radioactive steam that was inadvertently released to the air through a faulty hose coupling on a decontamination header. The header was used for routine preventive maintenance of transfer lines in the Tank Farm. The release occurred in 1964 when a section of the decontamination header was being flushed to allow the addition of new tie-ins to the header. During the flushing process, the facility operator discontinued flushing after steam was observed leaking to the atmosphere from a hose coupling. The weather conditions at the time of the release included high winds, which resulted in a cloud of steam contaminating an estimated 5.3 hectares (13 acres) to the northeast of the release location. Four of the hectares (10 acres) were outside the INTEC security fence present at that time. Currently, only about 0.4 hectare (1 acre) of the original 5.3 hectares (13 acres) is now outside the facility fence. (See Figures 3-2 and 3-3)

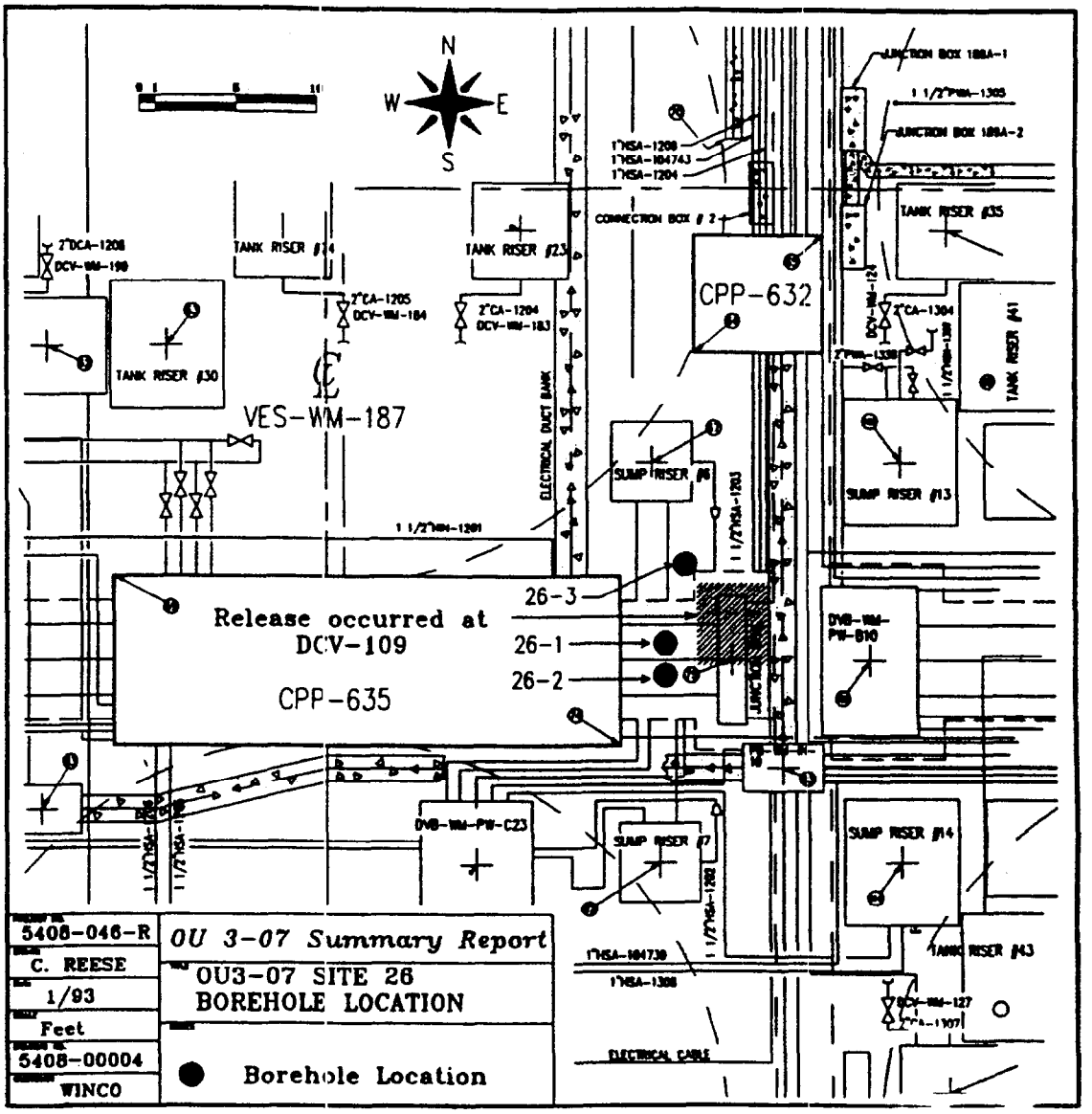


Figure 3-2. Location of the existing boreholes at Site CPP-26.

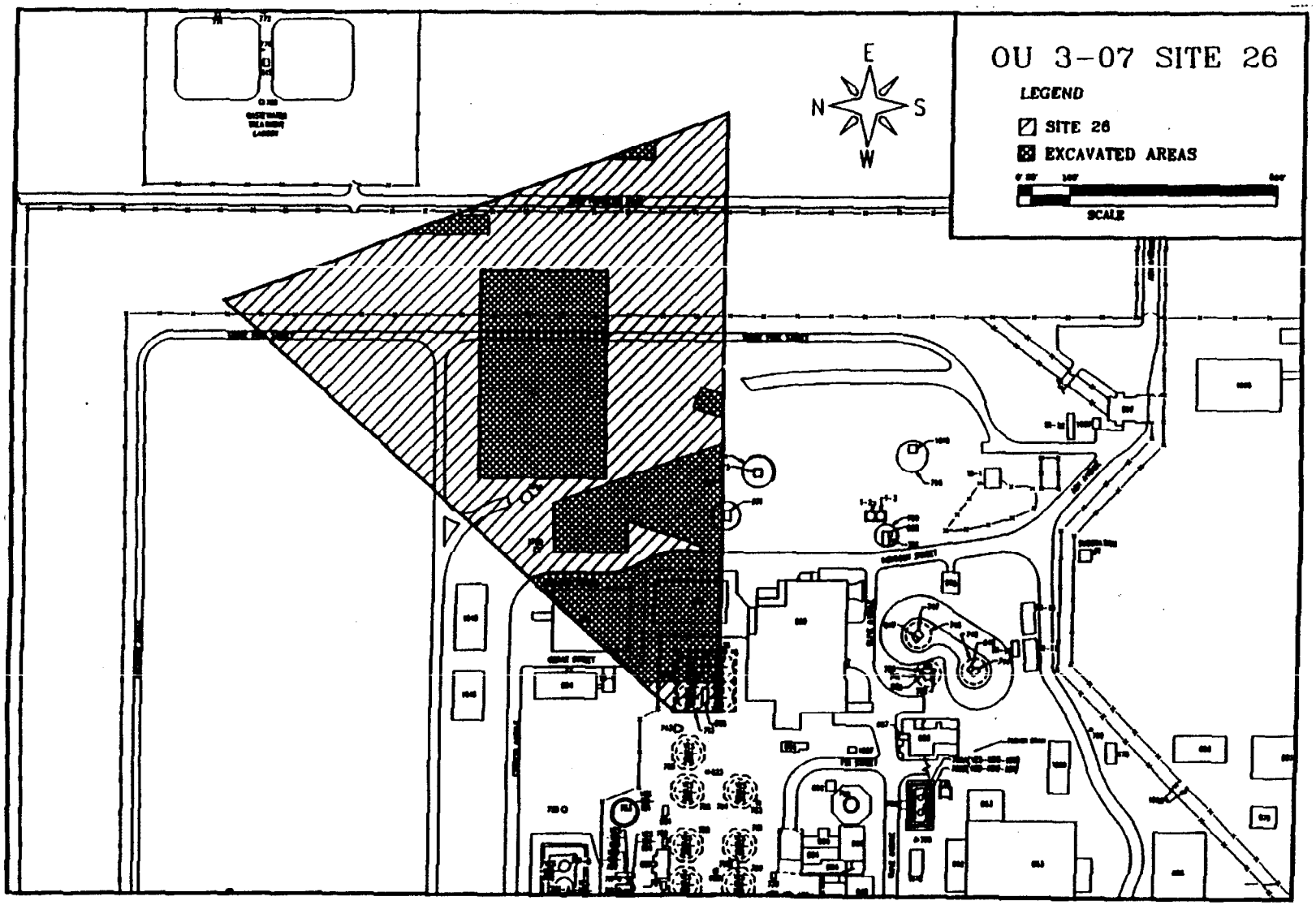


Figure 3-3. Location of the excavated area within site CPP-26.

Following the release, a sample of mud was collected near the decontamination header. It was found to contain 520 pCi/g Cs-137, 3.3 pCi/g Cs-134, 22,400 pCi/g Ce-144, 3,600 pCi/g Ru-106, 810 pCi/g Ru-103, and 0.03 pCi/g Pu-242. Reportedly, the liquid present near the header was cleaned up, solidified, and sent to the Radioactive Waste Management Complex (RWMC) for disposal. A surface radiation survey following the 1964 incident detected between 2 and 10 mR/hour in the soil, with one area as high as 200 mR/hour of gross radiation.

The CPP-26 site has been disturbed extensively since the release. A portion of the release site nearest to the decontamination header was excavated during the construction of buildings CPP-699 and CPP-654, and Calcined Solids Storage Facilities 4, 5, and 6. A portion of the site has been covered by the construction of Hemlock Street. Any remaining contamination from the release that is within the current Tank Farm boundaries has been covered with 0.6 m (2 ft) of soil, a 0.5-mm (20-mil) thick membrane liner, and an additional 15 cm (6 in.) of soil to prevent the liner from blowing away. Therefore, the contamination from the steam release would be expected to be approximately 0.8 m (2.5 ft) bgs in the Tank Farm area.

3.1.1.6.1 Data Review—In 1991, a surface radiation survey of the area was performed. Elevated gamma/beta radiation was not detected on the surface outside the Tank Farm that had not been disturbed since the steam release incident. Site CPP-26 was characterized as part of the OU 3-07 Track 2 investigation in 1992 (WINCO 1993d). A stainless steel hand auger was used to drill three boreholes in the Tank Farm soil near the location of the steam release to determine the nature and extent of residual contamination. (See Figures 3-2, 3-3 and 3-7). These three boreholes were located to the east and northeast of building CPP-635. Two boreholes were drilled to approximately 1.8 m (6 ft) below the Tank Farm liner; the third borehole was abandoned at 1.2 m (4 ft) below the liner because of the presence of concrete. Nine soil samples, including three duplicate samples, were collected from the three boreholes. The selection of the appropriate depths in each borehole from which to collect the soil samples was based on the highest measured radiation reading on soil collected as the borehole was drilled. The collected samples were analyzed for VOCs, selected metals, fluoride, nitrate, nitrite, pH, and radionuclides.

The radionuclides detected in the soil during the Track 2 investigation consist primarily of Sr-90, Cs-137, Eu-154, and lower levels of Pu-238, Pu-239, and Am-241. The highest concentrations (Sr-90 up to 15,800 pCi/g and Cs-137 ranged from 108 ± 9.08 pCi/g to 6460 ± 465 pCi/g) were measured in samples collected between 1.2 to 1.5 m (4 to 5 ft) bgs (WINCO 1993d).

3.1.1.6.2 Contaminant Summary— Site CPP-26 was evaluated as part of the OU 3-13 RI/BRA, using analytical results obtained from the borehole samples and process knowledge. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-13 RI/BRA are Am-241, Cs-137, Eu-154, Pu-238, Pu-239, Sr-90, U-234, and U-235. (DOE-ID 1997a, Section 5.2). These contaminants include long half-life daughter radionuclides created from decay of the parent radionuclide. Long-life daughter radionuclides contribute to the risk. Parent radionuclides, Pu-238 and Pu-239, decay to U-234 and U-235, respectively. Section 3.1.4 summarizes the contaminants at OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.6.3 Characterization Uncertainty— Whether the contamination detected from the three boreholes is from the CPP-26 steam release is uncertain. The maximum concentration detected for Cs-137 is approximately one order of magnitude higher than would be expected, based on radioactive decay of the most radioactive sample at the time of release in 1964. Furthermore, a significant increase in gross beta-gamma radioactivity was measured at a depth of approximately 1.2 m (4 ft) bgs.

The characterization uncertainties with site CPP-26 are listed below:

- Site characterization (previous samples were collected adjacent to the source)
- Radiation activity levels
- Source of the contamination (boreholes may be located at a different source than the CPP-26 release)
- Source volume released
- Spatial extent of contamination
- Source term.

3.1.1.7 Site CPP-27 and CPP-33 Description. Sites CPP-27 and CPP-33 were determined to be related to releases from the same source and, therefore, are being addressed as a single release site. These sites consist of soil contaminated by a subsurface release of high-level liquid waste from the Tank Farm transfer system near the northeast corner of building CPP-604 (Figure 3-1).

The soil contamination was first discovered in 1974 and determined to be from a broken transfer line (3"-PLA-1011) located 3.7 m (12 ft) bgs. This is the release designated as CPP-27. The amount of high-level waste was estimated at less than 379 L (100 gal) of high-level waste and between 379 and 1,136 L (100 and 300 gal) of low-level radioactive waste, containing approximately 1,000 to 3000 Ci of radioactivity was released. The source of the waste in the vent lines was either the high-level liquid waste (HLLW) tanks or PEW evaporator tank (WL-102). It was suspected that the line had been leaking since approximately 1961. Radiation readings in the soil were reportedly as high as 25 R/hour.

The contaminated soil was excavated and boxed for disposal at RWMC (area labeled 1974 excavation in Figure 3-4). The contamination was found to have spread laterally as far as 6.1 m (20 ft) and vertically to a depth of 8.5 m (28 ft) bgs. A total of approximately 210 m^3 (275 yd^3) of soil was removed from the site. Analysis of samples collected from the site in 1974 indicated Cs-137, Sr-90, Cs-134, Eu-154, Sb-125, Ru-125, and Pu-239/240 were present in the contaminated soil. Cs-137 activities in the four samples collected over nearly a 3-month period ranged from 2.89E+4 pCi/g to 3.03E+6 pCi/g. The Sr-90 activities in three samples ranged from 9.45E+4 to 8.59E+4 pCi/g and Pu-239/240 activities in two samples were 4.59E+2 pCi/g to 2.97E+3 pCi/g. It was estimated that after removal of the contaminated soil, only 25 mCi of radioactivity was left at the site.

In 1983, additional contaminated soil attributed to the corroded line was encountered in the same general area while excavating soil to replace Tank WL-102. This contamination is thought to be the result of a separate release from the same transfer line. The contamination was designated as CPP-33 in the Federal Facility Agreement and Consent Order (FFA/CO) (DOE-ID 1991). Approximately 10,704 m^3 (14,000 yd^3) of soil were removed from the site in 1983 (see the area labeled 1983 excavation in Figure 3-4). Of this total, approximately 1,530 m^3 (2,000 yd^3) exceeding 30 mR/hour of beta-gamma radiation was removed and disposed of at the RWMC. The remaining 9,180 m (12,000 yd^3) were disposed of in trenches located in the northeast corner of INTEC. The excavated area was backfilled and a portion covered by an asphalt road. Reportedly, the residual contamination remained below and to the sides of the excavated and backfilled area (WINCO 1993c).

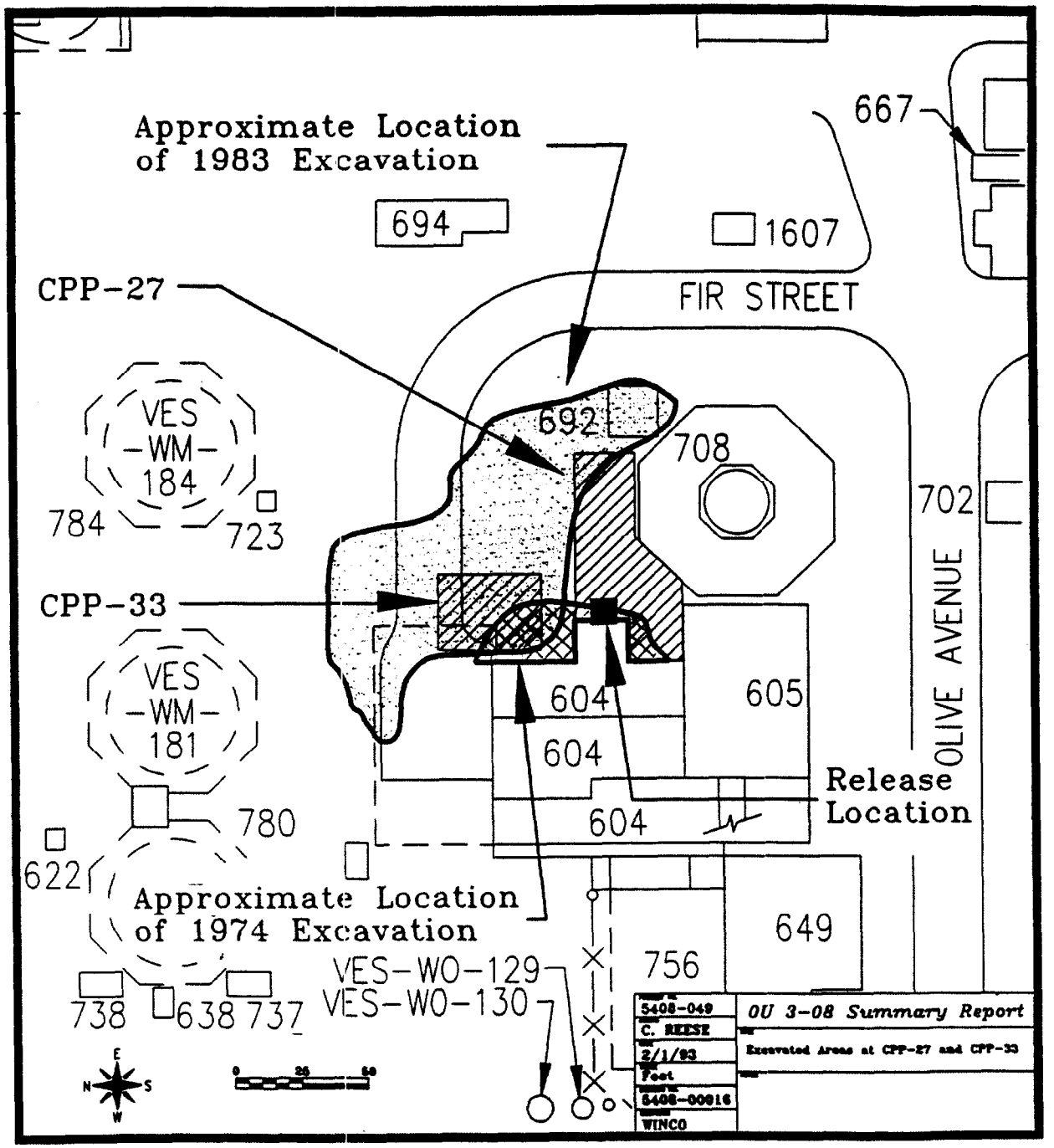


Figure 3-4. Map of sites CPP-27 and CPP-33 showing the boundaries of the sites and the locations of previous excavations.

3.1.1.7.1 Data Review— In 1987, 10 observation boreholes were drilled to the top of basalt in the CPP-27/33 area to determine the extent of contamination (see Figure 3-5). Direct radiation readings were taken in the observation boreholes using field instruments. No samples were collected from the boreholes for laboratory analysis. Information on the total depth of each borehole is also unavailable. Beta/gamma radiation readings in the boreholes ranged from none detected to 50,000 counts per minute (cpm). The location of the boreholes and the radiation reading recorded are shown in Figure 3-5.

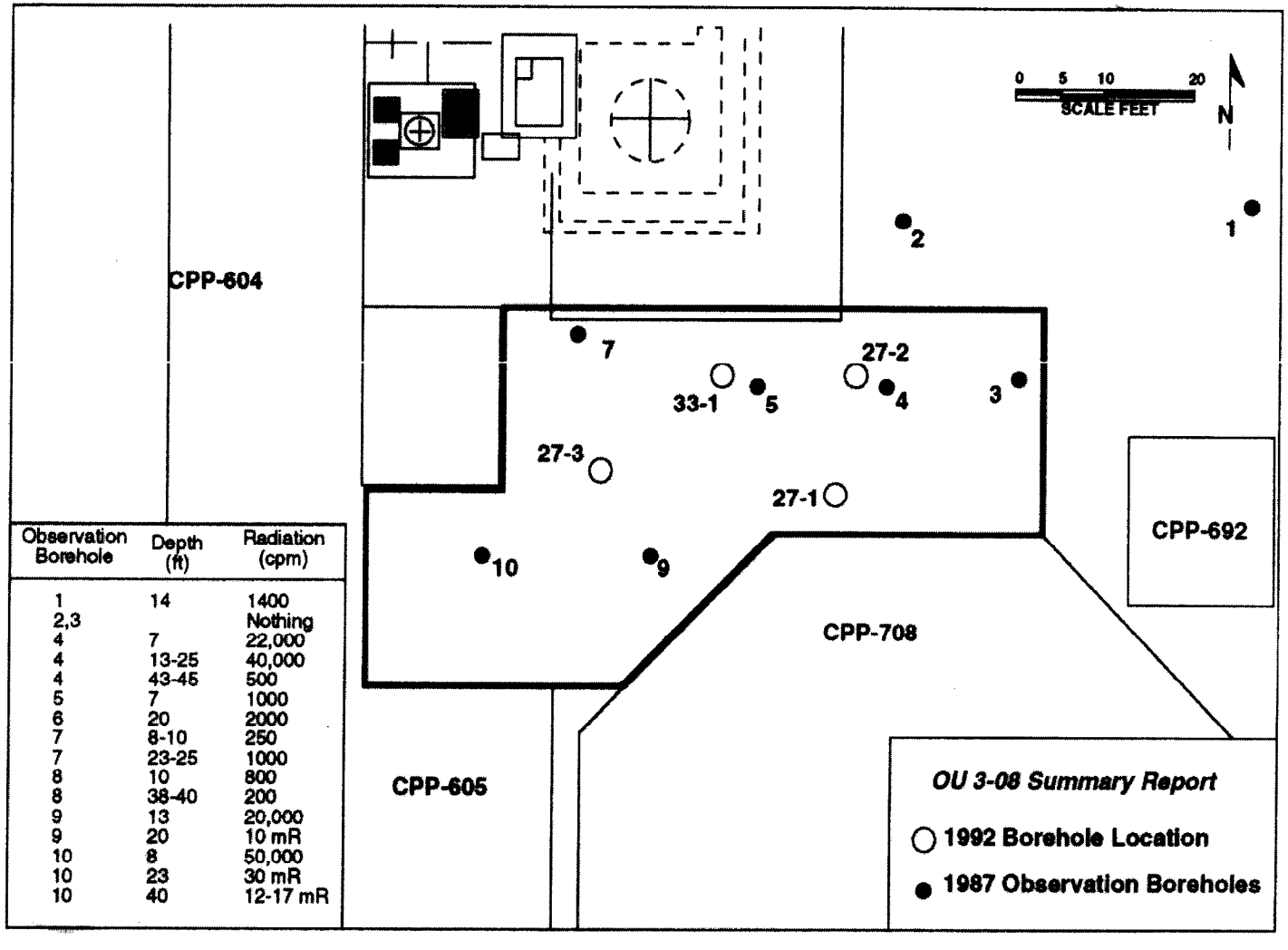
In 1990, a deep borehole was made in the area (completed as Monitoring Well CPP-33-1, see Figure 3-5) and 16 soil samples were collected from the soil above the basalt and two soil samples were collected from the 33.5-m (110-ft) interbed. The samples were analyzed for a full suite of constituents including VOCs, SVOCs, metals, dioxins and furans, cyanide, and radionuclides. The primary contaminants detected in the soil were Cs-137 and Sr-90. The depth of the highest activities found were between 2.1 m (7 ft) and 8.8 m (29 ft) bgs. The maximum activities detected were 608±3 pCi/g and 328±1.8 pCi/g, respectively for Cs-137 and Sr-90.

Sites CPP-27 and CPP-33 were characterized as part of the OU 3-08 Track 2 investigation in 1992 (WINCO 1993b). Three boreholes labeled CPP-27-1, CPP-27-2, and CPP-27-3 were made at the site (see Figure 3-5). Borehole CPP-27-1 was drilled to 14 m (46 ft) bgs and the other two boreholes were drilled to 3.7 m (12 ft) bgs. Twenty soil samples were collected and analyzed for VOCs, metals, selected anions, pH, and radionuclides. The selection of the appropriate depths in each borehole from which to collect the soil samples was based on the highest measured radiation reading on soil collected as the borehole was drilled. Sixteen of 20 samples analyzed by gamma spectroscopy had Cs-137 activities above expected background levels. Elevated Cs-137 were measured in borehole CPP-27-1 at depths from 0.6 m (2 ft) to 6.9 m (22.5 ft) bgs, in borehole CPP-27-2 at depths from 1.2 m (4 ft) to 3 m (10 ft) bgs, and in borehole CPP-27-3 at depths from 1.2 m (4 ft) to 1.8 m (6 ft) bgs. Slightly elevated alpha activities were found in boreholes CPP-27-1 and CPP-27-3 at depths from 1.8 to 4.9 m (6 to 16 ft) bgs and 1.2 to 3.6 m (4 to 12 ft) bgs, respectively.

3.1.1.7.2 Contaminant Summary—This site was evaluated as part of the OU 3-13 RI/BRA, using the analytical results from the borehole samples. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-13 RI/BRA are arsenic, chromium[a], Am-241, Cs-137, Cs-134, Eu-154, Np-237, Pu-238, Pu-239/240, Sr-90, and U-235 (DOE 1997A, Section 5.2). Section 3.1.4 summarizes the contaminants at OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.7.3 Characterization Uncertainty—Another source of contamination is suspected at site CPP-27 because the contamination found in borehole 27-1 was at a shallower depth than the leaking vent line and the contamination is in an area that has not been disturbed by excavation. The characterization uncertainties with site CPP-27 are summarized below:

[a] Chromium was not included in the source estimate for theTank Farm surface soil, it was eliminated in the screening process for OU 3-08 (DOE 1997A, Section 11). Chromium is part of the source estimate for future groundwater usage, given enough time, chromium will reach the SRPA (DOE 1997A, Sections 16 and 29).



Observation Borehole	Depth (ft)	Radiation (cpm)
1	14	1400
2,3		Nothing
4	7	22,000
4	13-25	40,000
4	43-45	500
5	7	1000
6	20	2000
7	8-10	250
7	23-25	1000
8	10	800
8	38-40	200
9	13	20,000
9	20	10 mR
10	8	50,000
10	23	30 mR
10	40	12-17 mR

Figure 3-5. Map of site CPP-27 showing the locations of previously drilled boreholes.

- Site characterization (potential new source may exist)
- Radiation activity levels
- Source of the contamination (borehole CPP-27-1 may be located at a different source than the initial CPP-27 release)
- Source volume released
- Spatial extent of contamination
- Source term.

3.1.1.8 Site CPP-28 Description. Site CPP-28 is the contaminated soil associated with a subsurface release of liquid waste from a breached transfer line (Figure 3-1). The leak is located south of tank WM-181 near valve box A-6 and extends as far south as borehole CPP-79-1 (see Section 3.1.1.15). The line was used to carry radioactive first-cycle extraction waste solutions from the uranium recovery process to the Tank Farm (see Figure 3-6). The breach, a 0.4-cm (one-eighth-in.) diameter hole drilled into a transfer line (PWA 1005), was discovered in 1974, during installation of a cathodic protection electrode. The breach of the line is suspected to have occurred during installation in 1955. Though the 7.6-cm (3-in.) stainless steel transfer line was enclosed in pipe encasement, deterioration of the encasement allowed liquid to be released through the joints to the surrounding soil. Contaminated soil, encountered at 1.8 m (6 ft) bgs in 1974, reportedly had radiation readings of up to 40 R/hour. At the time, it was estimated that 454 L (120 gal) of liquid waste containing 6,000 Ci of radioactivity was released between 1955 and 1974 (Allied Chemical 1974). This estimate was later shown to be low, as discussed below.

Following the 1974 discovery of contaminated soil, six boreholes were drilled in the area and a soil sample was collected from the bottom of each borehole. The samples were collected from depths that ranged from 2 m (6.5 ft) bgs to 3 m (10 ft) bgs. The samples were screened for radioactivity in the field. The highest activity (40 R/hour) was detected in a sample collected from a depth of 2 m (6.5 ft) bgs. The area around the transfer line was excavated and approximately 43 m^3 (56 yd^3) of contaminated soil having an estimated 3,000 Ci of gross radioactivity was removed. Samples taken from the contaminated soil had the following distribution of radionuclides (by activity): 0.2% Mn-54, 0.5% Co-60, 3.2% Ru/Rh-106,1.4% Cs-134, 12.2% Cs-137, 21.4% Ce-144, 1.3% Eu-154, 0.8% Eu-155, and 59% Sr/Y-90. No contaminated soil below the pipe encasement (approximately 2 m (6.5 ft) bgs) was removed because of the high radiation levels. It was estimated that approximately 4.2 m^3 (4.7 yd^3) of contaminated soil was left in place and the excavation backfilled. Eleven boreholes were installed in the backfilled excavation to measure the radiation levels in the soil. Radiation readings in each of the boreholes were measured to a depth of 3.7 m (12 ft) bgs. Significant subsurface radiation was detected in four of the boreholes and indicated that the contamination extended to a depth of approximately 2.7 m (9 ft) bgs. The horizontal extent of contamination at the site was estimated to be 2.7 m (9 ft) in diameter. The boreholes were supposedly cut off belowgrade and abandoned. An attempt was made to locate and excavate the 1974 observation boreholes during the OU 3-07 Track 2 investigation in 1992 (WINCO 1993d). The investigation failed to locate the boreholes and it is uncertain whether the wells are still present at the site or have been removed.

During the 1993 to 1996 Tank Farm upgrades, portions of sites CPP-28, CPP-25, CPP-20 and CPP-79, were excavated. Excavation depths ranged from 0 to 11 m (0 to 35 ft) bgs, with most being completed at approximately 4.6 m (15 ft) bgs. Field gamma/beta radiation measurements encountered during excavation ranged from 0 to 5 R/hour.

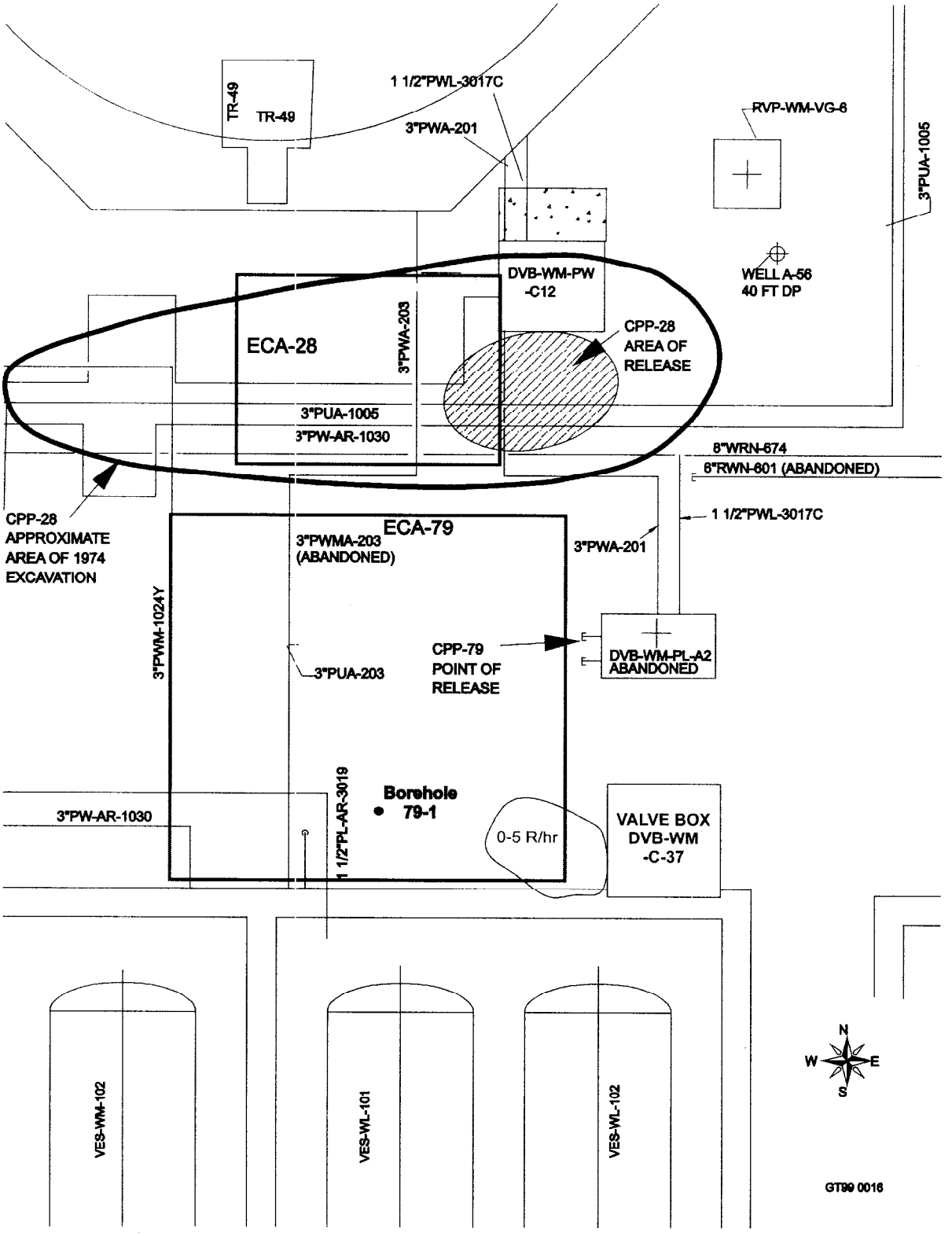


Figure 3-6. Map of an area just north of the building CPP-604 loading dock showing locations of release points for sites CPP-28 and CPP-79.

Information gained during characterization of site CPP-79 led investigators to believe that the depth and extent of contamination at CPP-28 have been underestimated. Soil in borehole CPP-79-1, which is located approximately 9.1 m (30 ft) southeast of the location of the transfer line leak (CPP-28), was found to be contaminated at a depth of 9.1 (30 ft) bgs. Field readings were measured of 90 R/hr at a depth of 2.4 m (8 ft) bgs and of 400 R/hour on a sample at about 9.1 m (30 ft) bgs while borehole CPP-79-1 was being drilled. Samples collected from Borehole CPP-79-1 (Figure 3-7) have significant gross alpha (8.09E5±9.7E4 pCi/g) and beta (1.89E6±1.5E6 pCi/g) activities with high concentrations of Cs-137 (3.37E7±1.1E6 pCi/g), Sr-90 (5.41E6±4.9E3 pCi/g) and Am-241 (1.66E4±2.2E3 pCi/g). The extremely high concentrations of radionuclides strongly suggest that the contamination is related to a leak of first-cycle raffinate such as at site CPP-28. In addition, the preferential migration pathway from CPP-28 to Borehole CPP-79-1 would be the sandy backfill placed in pipeline excavations. The data suggest that contamination at CPP-28 extends from 2 m (6.5 ft) bgs to the soil basalt interface at 12.8 m (42 ft) bgs and south of the original release site because tank WM-181 is immediately north of the site. Based on this and the proximity of the CPP-79-1 borehole to the transfer line leak, the original (1974) estimates of the quantity of waste released to the soil at CPP-28 were reevaluated.

3.1.1.8.1 Data Review—Bounding calculations were conducted to estimate the amount and activity of first-cycle extraction waste that leaked through the hole in the pipeline. Converting conservative radiological field screening readings (400 R/hour) to the concentration of Cs-137 were used to obtain a Cs-137 activity of 34 Ci/L (9 Ci/gal) for the release. Using an estimated amount of liquid waste transferred through the pipeline during its operational lifetime, the total release of 13,627 L (3,600 gal) from the pipeline was on the order of 32,000 Ci. Tank Farm soil containing an estimated 3,000 Ci was reportedly excavated from the area in 1974. Therefore, the estimated release in the vicinity of the pipeline is 29,000 Ci (WINCO 1993d).

Because of the lack of soil sampling data for the release, the OU 3-07 Track 2 investigation (WINCO 1993d) estimated contaminant concentrations in soil based on a release of first-cycle raffinate with a composition from operations during the 1971–74 timeframe and adjusted for 18 years of radioactive decay. These contaminant estimates did not include Pu-238. A value of 276,000 pCi/g measured in nearby borehole CPP-79-1 (Figure 3-7) at about 12 m (40 ft) bgs was added because this contaminant is expected to be present at about 3 m (10 ft) bgs because it has been measured in adjacent areas and is known to be part of the process that led to this release. No attempt was made to estimate metals or organic compounds that may have been released at this site. However, data concerning the concentrations of metals and radionuclides were used to provide a source estimate of the masses of individual metals and radionuclides for the Track 2 investigation (WINCO 1993d).

3.1.1.8.2 Contaminant Summary—This site was evaluated as part of the OU 3-13 RI/BRA. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-13 RI/BRA are Ce-144, Cs-134, Cs-137, Co-60, Eu-154, Np-237, Pu-239, Pu-240, Pu-241, Pu-242, Ru-106, Sr-90, H-3, U-234, U-235, and U-236. (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.8.3 Characterization Uncertainty—The characterization uncertainties with site CPP-28 are summarized below:

- Site characterization
- Source of release Source volume released

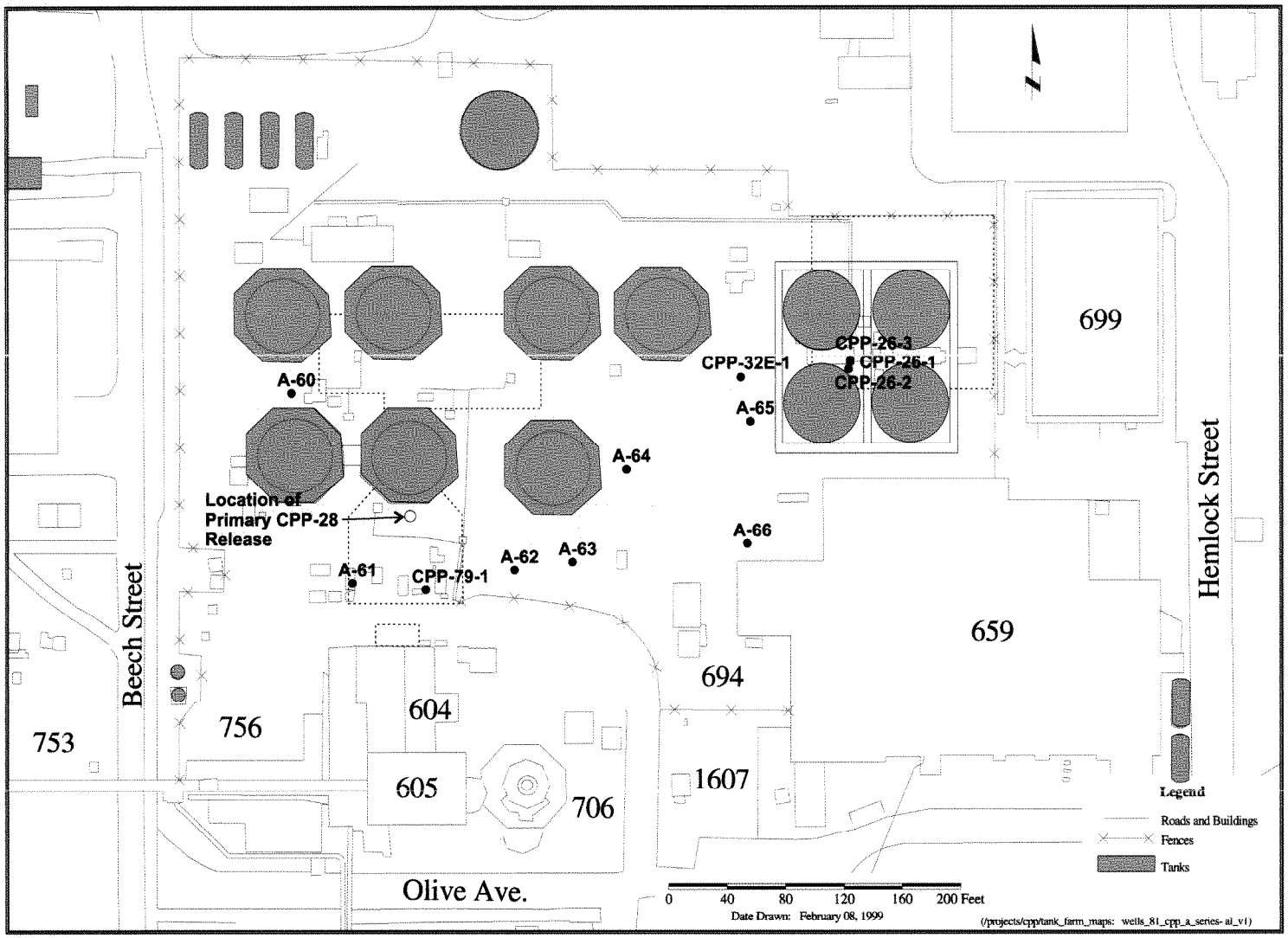


Figure 3-7. Map of the Tank Farm showing locations of boreholes drilled around sites CPP-28 and CPP-79.

- Spatial extent of contamination (The depth and extent may be larger than initially thought. Site CPP-28 contamination may have been found as far southeast as borehole CPP-79-1.)

- Source term.

3.1.1.9 Site CPP-30 Description. Site CPP-30 is an area of radioactively contaminated soil near valve box B-9 that was discovered by maintenance personnel in 1975 (Figure 3-1). The contamination covered an area of 37.2 m^2 (400 ft^2) and produced radiation levels of up to 1 R/hour. The area was contaminated during a one time preventative maintenance activity in which residual decontamination solution from the floor of the value box contaminated personnel clothing and equipment, which were brought to the surface and inadvertently placed on blotter paper that covered the ground surface. The contamination spread to the soil either through handling or tears in the blotter paper. The contaminated soil was removed, placed in 55-gal drums, and disposed of at the RWMC (WINCO 1993d; DOE-ID 1994). Subsequent surface radiation surveys in the area have not shown radiation levels above background.

This site was recommended in a Track 2 investigation as a no further action site because the entire area has been excavated in the past and the contaminated soil was removed (WINCO 1993d). Site CPP-30 is being reinvestigated because with the consolidation of all Tank Farm soil and sites within CPP-96, this site is subject to OU 3-14 RI/FS activities.

3.1.1.9.1 Data Review— No known sampling has been done at site CPP-30.

3.1.1.9.2 Contaminant Summary— No known sampling was performed, and the contaminants are unknown. .Section 3.1.4 summarizes the contaminants at the OU 3-14 sites.

3.1.1.9.3 Characterization Uncertainty— The characterization uncertainties with site CPP-30 are listed below:

- Site characterization

- Quantity of contamination released

- Spatial extent of contamination

- Source term.

3.1.1.10 Site CPP-31 Description. Contamination at site CPP-31 was discovered in 1975 during drilling operations. A monitoring borehole (A-53) was being drilled at a location approximately 4.6 m (15 ft) west of tank WM-183 and 3 m (10 ft) south of the edge of the tank vault (see Figure 3-1). Beta/gamma radiation levels in the soil brought to the surface during the auger drilling, reportedly ranged from 100 R/hour, at 4.6 m (15 ft) bgs to 500 R/hour at 6.7 m (22 ft) bgs.

An investigation into the source of contamination at site CPP-31 revealed that in November 1972, liquid radioactive waste was released to the surrounding soil during a transfer between tanks WM-181 and WM-180. During the transfer, the liquid waste was inadvertently routed through an 8-cm (3-in) diameter carbon steel waste transfer line (WRV-1037). Though not in use, the waste had entered the line, located approximately 1.5 m (5 ft) bgs through a normally closed valve (WRV-1147). The cause of the corrosion and failure of the carbon steel line is speculated to be the highly acidic waste. An estimated 52,996 L (14,000 gal) of waste was released, contaminating approximately 459 – 612 m^3 (600 to 800 yd^3)

of soil. The waste was calculated to contain 28,000 Ci of fission products, primarily Cs-137, Sr-90, and Y-90 (Allied Chemical 1975).

3.1.1.10.1 Data Review— In 1975 following the discovery of the release, the carbon steel line was cut at the valve and capped to prevent any further waste from entering the line. To investigate the release, 33 "observation boreholes" (designated as A53 through A53-31 and A-55) were installed to delineate the extent of contamination in the subsurface (see Figure 3-8). Following installation, direct radiation readings were obtained in the boreholes by lowering a string of thermoluminescent dosimeter (TLD) chips down the pipe for a period of 1 hour. Readings from the boreholes ranged from background levels to 50 R/hour. Based on the readings obtained, the zone of greatest contamination was estimated to be between 4 m (13 ft) and 6 m (20 ft) bgs. Seven boreholes had readings of 10 R/hour or greater at one or more points between 4 m (13 ft) and 6 m (20 ft) bgs. In the general vicinity of valve box A-6, high radiation fields (up to 4 R/hour) were measured at depths of 0.6 to 3 m (2 to 10 ft) bgs. Based on these measurements, the volume of the contaminated soil was estimated to be approximately 150 m^3 (200 yd^3) in the 10 R/hour range and 300 m^3 (400 yd^3) in the 1 R/hour range.

Soil samples were collected in 1975 and analyzed for radionuclides. Using this data, 1992 soil concentrations were calculated based on 18 years of radioactive decay. Estimated 1992 radionuclide concentrations include Cs-137 (at up to 2,190,000 pCi/g), Sr-90 (up to 710,000 pCi/g), Pu-239/Pu-240 (up to 1,500 pCi/g), and U-235 (up to 9,000 pCi/g). Other radionuclides estimated to be present at lesser concentrations are Co-60, Cs-134, and Ru-106.

In the early 1980s, several additional boreholes, designated the 81-series, were installed in the Tank Farm area. As part of the 1992 OU 3-07 Track 2 investigation (WINCO 1993d), radiation readings were collected from 10 of the A53 and 81 series "observation boreholes." Readings ranged from background levels to 22,300 mR/hour. Based on the down-hole gamma radiation readings, a map showing cross sections of the contamination zone at CPP-31 was prepared (Figure 3-9). The available information indicates that most of the soil contamination is concentrated between 3 to 7.6 m (10 to 25 ft) bgs in the area of the HLLW transfer lines PWA-1005 and 1030, with a smaller but shallower source of high soil contamination in the immediate area surrounding valve box A-6.

3.1.1.10.2 Contaminant Summary—This site was evaluated as part of the OU 3-13 RI/BRA. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-13 RI/BRA are Cs-134, Cs-137, Co-60, Eu-154, Pu-239/240, Ru-106, Sr-90, and U-235. (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at OU 3-14 sites. Section 3.2 summarizes the risk assessment result from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.10.3 Characterization Uncertainty—The characterization uncertainties with site CPP-31 are summarized below:

- Site characterization
- Release characteristics of the source
- Spatial extent of contamination source term
- Source term (the estimated 28,000 Ci represents about 50% of known Tank Farm soil source).

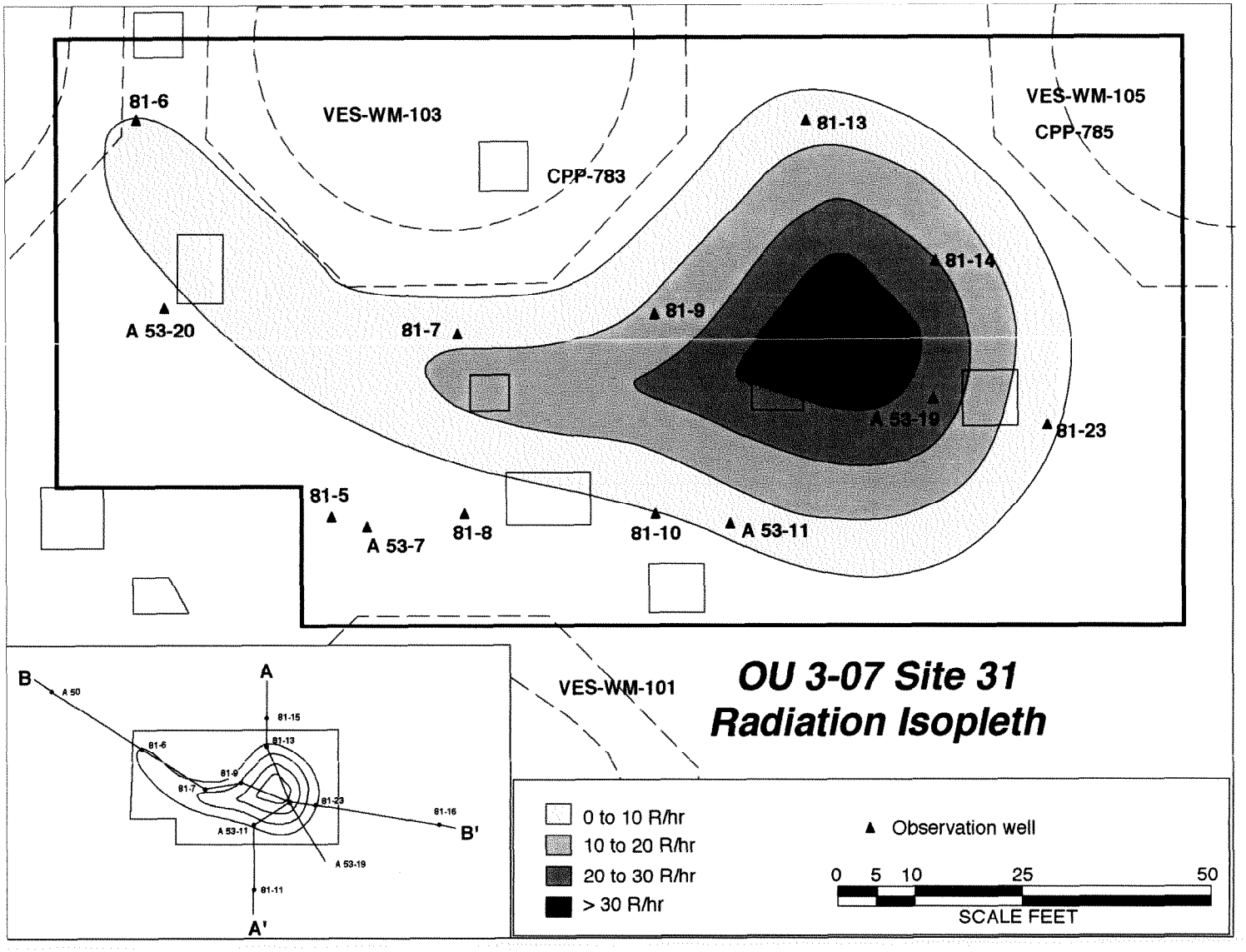


Figure 3-8. Map of Site CPP-31 showing locations of boreholes installed to characterize the extent of contamination in Tank Farm soil.

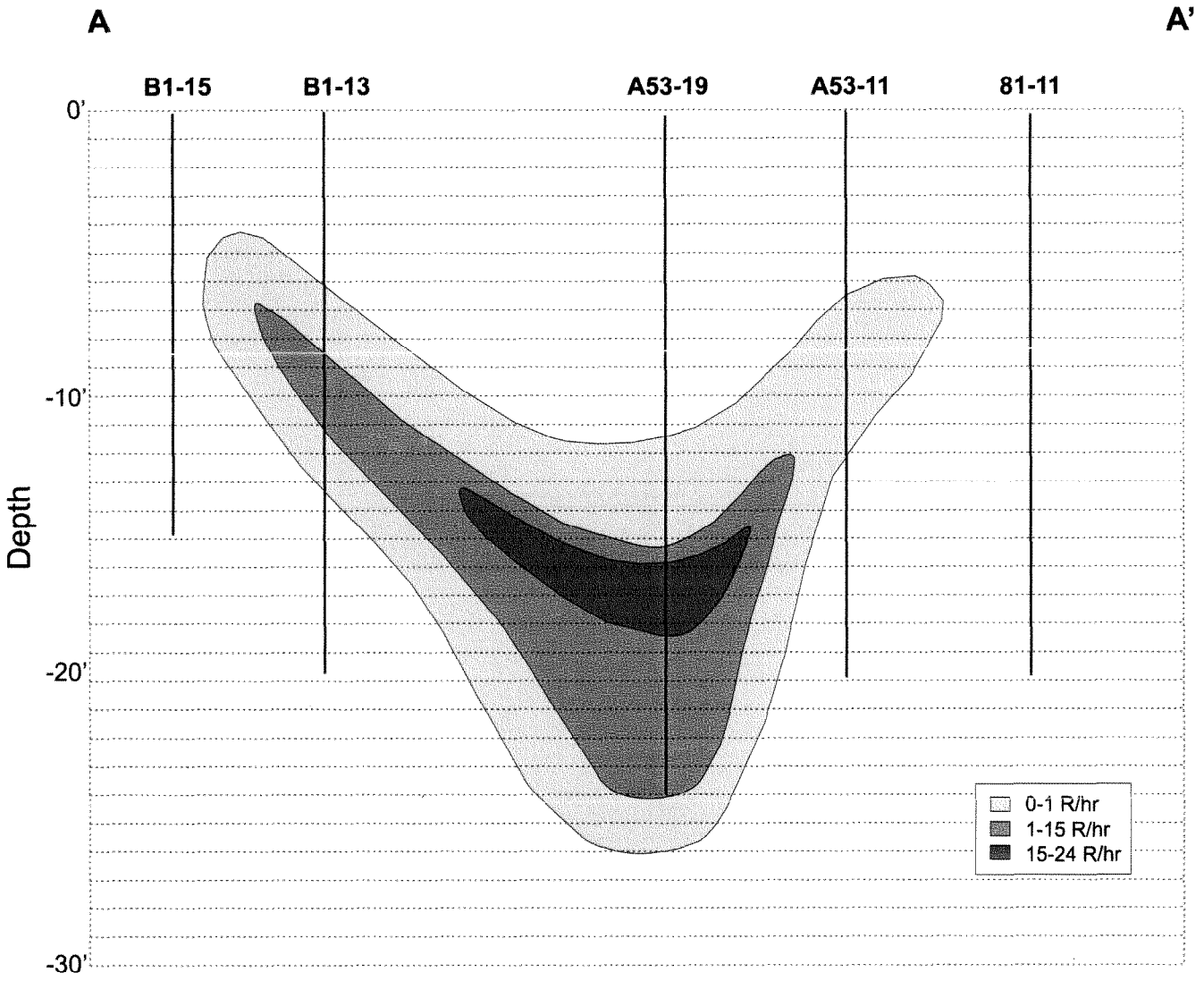


Figure 3-9. Map and cross-section drawing of site CPP-31 showing the estimated lateral extent and vertical distribution of contamination based on gamma logs in boreholes.

3.1.1.11 Site CPP-32 Description. Sites CPP-32E and 32W are two areas of localized contamination near valve box B-4 (Figure 3-1). The contamination at CPP-32E (southwest of valve box B-4) appears to have originated from the condensation of contaminated water vapor in valve box B-4 that was released to the ground surface from the stand pipe (air vent tube and view port pipe) that extends out of the valve box. This area is approximately 0.7 m^2 (8 ft^2) and extends to a depth of about 0.3 m (1 ft) bgs.

Site CPP-32W is approximately 15 m (50 ft) northwest of valve box B-4 and the source of the release is suspected to be a result of a leak of radioactive liquid from a 5.1-cm (2-in.) diameter aboveground transfer line used to pump water from tank sumps to the PEW evaporator. This area is approximately 0.6 m^2 (6 ft^2) and extends to a depth of about 0.3 m (1 ft). Both sites were identified in December 1976 and described as having surface radiation contamination up to 2 R/hour. It is unknown if any cleanup of the sites occurred after they were identified in 1976. Both of these surface releases have since been covered with 0.76 m (2.5 ft) of soil and the Tank Farm membrane, which was installed in 1977.

3.1.1.11.1 Data Review—During the OU 3-07 Track 2 investigation in 1992 (WINCO 1993d), only soil samples from site CPP-32E were collected. Not knowing the exact release location and desiring not to penetrate the Tank Farm membrane unnecessarily, the field team took no samples from CPP-32W. When a soil borehole was drilled adjacent to the vent tube a depth of 1.5 m (5 ft) below the Tank Farm membrane, the concrete valve box was encountered. Therefore, the field team was unable to drill the borehole to the projected depth of 1.8 m (6 ft). The sample results from site CPP-32E are assumed to be representative of the contaminant concentrations at site CPP-32W.

During field screening, the highest beta/gamma radiation reading, 900 cpm above background, was detected between 0.4 to 4 m (1.4 and 2.9 ft) below the membrane about 0.76 m (2.5 ft) below the current ground surface. This depth is roughly equivalent to the ground surface at the time of the release. At the bottom of the borehole, the beta-gamma radiation had decreased to 250 cpm above background. Based on the field radiation measurements, one soil sample was collected at a depth of 0.43 to 0.70 m (1.4 to 2.3 ft) and two soil samples were collected at a depth of 0.67 to 0.88 m (2.2 to 2.9 ft) below the membrane. The samples were analyzed for VOCs, two metals, mercury and cadmium, gamma-emitting radionuclides, gross alpha and gross beta radiation, and Sr-90.

The gross alpha concentrations from the three samples ranged from 14.8 pCi/g to 21.5 pCi/g and were within normal background concentrations. Therefore, no isotopic analysis of the alpha-emitting radionuclides was performed. The gross beta concentrations from the three samples ranged from 350 pCi/g to 724 pCi/g with the subsequent isotopic analysis of Sr-90 ranging from 153 pCi/g to 278 pCi/g. Of the anthropogenic gamma-emitting radionuclides, only Cs-137, at concentrations, ranging from 133 pCi/g to 277 pCi/g, and Eu-154, at concentrations, ranging from 0.456 pCi/g to 0.811 pCi/g, were detected.

3.1.1.11.2 Contaminant Summary—Site CPP-32E/W was evaluated as part of the OU 3-13 RI/BRA. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-13 RI/BRA are Cs-137, Eu-154, and Sr-90 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.11.3 Characterization Uncertainty—The characterization uncertainties with site CPP-32E and CPP-32W are summarized below:

- Site characterization (CPP-32E and CPP-32W [no previous samples of CPP-32W])

- Exact spill location
- Source volume released
- Spatial extent of contamination
- Source term.

3.1.1.12 Site CPP-33 Description. This site (CPP-33) is addressed under site CPP- 27, (see Section 3.1.1.7).

3.1.1.13 Site CPP-58E Description. Site CPP-58 was partitioned into two separate units (CPP-58E and CPP-58W) for evaluation because it is composed of two separate areas of soil contaminated by leaks of PEW evaporator condensate (Figure 3-1). Site CPP-58W is now located beneath building CPP-649. The presence of the building precluded the collection of soil samples at site CPP-58W (see subsection 1.1.14). Samples from site CPP-58E were used for assessing the nature of contamination at site CPP-58W for the OU 3-13 BRA (DOE-ID 1997a).

Site CPP-58E has contamination resulting from a 1976 subsurface release of PEW evaporator condensate. The PEW evaporator was used to concentrate all dilute low and intermediate-level radioactive liquid waste. The concentrated "bottoms" solution from the PEW evaporator was sent to the Tank Farm as incidental liquid waste and the "overhead" condensate was sent to the service waste system. An estimated 75,700 L (20,000 gal) of condensate was released because a transfer line failed between the PEW evaporator and the service waste diversion system in building CPP-751. The release occurred at a point in the transfer pipe where it makes a 90° turn and the diameter of the line narrows from 8 cm to 5 cm (3in. to 2 in.) The line is buried 1.8 m (6 ft) bgs. An estimated 51 mCi of H-3, 2 mCi of Sr-90, 4 m Ci of u-106, 2 mCi of Cs-137, and 1 m Ci of Ce-144 were released. Though the damaged line was repaired, the contaminated soil was likely left in place and covered with clean soil.

3.1.1.13.1 Data Review—As part of the 1992 Track 2 investigation for OU 3-11 (WINCO 1993a), two boreholes were made at the CPP-58E site. The locations of the boreholes were selected so that underground utilities would not be damaged. One borehole was drilled to a depth of 3.6 m (12 ft) bgs and was located approximately 9.1 m (30 ft) southwest of the release. The other was drilled to a total depth of 14 m (46 ft) bgs and was located within 3.6 m. (12 ft) of the release site. It was planned that samples for laboratory analysis would be collected from intervals exhibiting the highest gamma/beta radiation fields as measured with field instruments. However, no radiation above background was detected in either borehole; therefore, samples that were representative of the entire drilled intervals were collected. Thirteen samples were collected from the two boreholes and analyzed for VOCs, selected metals (mercury and cadmium), fluoride, nitrate, nitrite, pH, and radionuclides.

Sampling and analysis showed gross alpha activity ranged from 3.92±0.67 pCi/g to 24.4±3.28 pCi/g. Only the sample collected from 2.4 to 3.0 m (8 to 10 ft) in borehole CPP-58E-1 exceeded the background activity of 20 pCi/g. Subsequent isotopic analyses for alpha-emitting radionuclides on this sample detected U-234 and U-238 below background concentrations and Pu-238, U-235, Pu-239, and Am-241 above background concentrations.

Sampling and analysis showed Cs-137 and Sr-90 as present above background levels. The gross beta activity ranged from 31.3±2.78 pCi/g to 271±22.1 pCi/g with all samples exceeding background activity of 30 pCi/g. Subsequent isotopic analysis for Sr-90 detected concentrations ranging from 0.877±0.276 pCi/g to 33.4±3.17 pCi/g. In general, lower concentrations of Sr-90 were measured in borehole CPP-58E-2 than in CPP-58E-1. This is consistent with borehole CPP-58E-1 being closer to the

location of the release. The results of the gamma analysis detected only Cs-137 and K-40. The concentrations of K-40 are within normal background ranges. Cs-137 activities ranged from 0.269±0.0211 pCi/g to 63.1±4.57 pCi/g with the higher concentrations detected at a depth of less than 6.7 m (22 ft) in borehole CPP-58E-1 and at depths less than 3.0 m (10 ft) in borehole CPP-58E-2.

Below a depth of 1.8 m (6 ft) bgs, the primary contaminants detected were Cs-137 and Sr-90. This is consistent with the waste stream that was reported to have been released. Cs-137 concentrations are generally higher than Sr-90 concentrations above 6.7 m (22 ft) in borehole CPP-58E-1 and above 3.7 m (12 ft) in borehole CPP-58E-2. Below these depths, Sr-90 concentrations are higher than Cs-137 concentrations. This relationship is believed to be the result of the greater mobility of Sr-90 relative to Cs-137, given that these two radionuclides were likely in roughly equal concentrations in the released condensate. The contaminated zone for this site is estimated as being present from 1.8–14.0 m (6–46 ft) bgs. The volume of contaminated soil is estimated as 7,702 m^3 (272,000 ft^3).

3.1.1.13.2 Contaminant Summary—Site CPP-58E was evaluated as part of the OU 3-13 RI/BRA. The retained OU 3-13 contaminants from the contaminant screen process in the OU 3-1 RI/BRA are Am-241, Cs-137, Eu-154, Pu-238, Pu-239, Sr-90, and U-235 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.13.3 Characterization Uncertainty—The characterization uncertainties with site CPP-58E are summarized below:

- Site characterization (to confirm estimated activity released)
- Radiation activity levels
- Spatial extent of contamination.

3.1.1.14 Site CPP-58W Description. Site CPP-58 is composed of two areas of soil contamination associated with the PEW evaporator. Site CPP-58E is soil contamination resulting from a subsurface release of PEW evaporator condensate in 1976 (see Section 3.1.1.13) and site CPP-58W consists of soil affected by a release of PEW evaporator condensate in 1954. The PEW evaporator was used to concentrate all dilute low and intermediate-level radioactive liquid waste. The concentrated bottoms solution from the PEW evaporator was sent to the Tank Farm as incidental liquid waste and the overhead condensate was sent to the service waste system. The condensate leaked from a transfer line buried 1.8 to 2.4 m (6 to 8 ft) bgs, between buildings CPP-604 and CPP-601. No information is available on how often the transfer line was used, how long the pipe leaked, the quantity of condensate released, or the length, width, or depth of contamination. Since the time of the release, building CPP-649 was constructed on top of the area where the spill occurred. If the contaminated soil was not removed during excavation for the building footers, it is believed to be contained below the building.

3.1.1.14.1 Data Review—Because site 58W is located beneath building CPP-649, the presence of the building prevents the collection of soil samples (WINCO 1993a).

3.1.1.14.2 Contaminant Summary—Samples from site CPP-58E were used in the OU 3-13 RI/BRA for evaluating the risk from site CPP-58W. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-1 RI/BRA are Am-241, Cs-137, Eu-154, Pu-238, Pu-239,

Sr-90, and U-235 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.14.3 Characterization Uncertainty—The characterization uncertainties with site CPP-58W are summarized below:

- Site characterization (no previous samples of CPP-58W)
- Radiation activity levels
- Source volume released
- Spatial extent of contamination
- Source term.

3.1.1.15 Site CPP-79 Description. South of tank WM-181 are sites CPP-28 and CPP-79 (see Figure 3-6). Site CPP-79 is defined as soil contaminated in July and August of 1986 by the releases of waste solutions due to an obstruction in a transfer line buried about 3.0 m (10 ft) bgs. However, during investigations a second, deeper zone of contamination was discovered beneath this site and is discussed with site CPP-28 (see Section 3.1.1.8).

On July 7, 1986, during a transfer from the Waste Calcining Facility (WCF) sump tank (WCF-119) to the PEW evaporator feed tank (WL-102) and again on August 2, 1986, during a transfer from the New Waste Calcining Facility (NWCF) decontamination area sump tank (NCD-123), the volume of liquid received at tank WL-102 did not match the volume transferred. An investigation revealed that a valve in the transfer line was partially closed, causing waste solutions to backup into valve box A-2. The waste exited valve box A-2 along the secondary tile encasement of two waste transfer lines and drained to the soil through leaks in the tile encasement (Unusual Occurrence Report WIN-86-0034-CPP, included in Appendix E). Approximately 9,463 L (2,500 gal) of liquid waste was released containing radionuclides, heavy metals, and traces of organic compounds. The transferred liquid waste could have been low-level or intermediate-level, low-fluoride waste. It is believed that part of the contaminated soil at this site was removed during the 1994 Tank Farm upgrade project.

3.1.1.15.1 Data Review—During the OU 3-07 Track 2 investigation in 1992 (WINCO 1993d), one soil borehole was drilled in the soil near the release site (borehole CPP-79-1; see Figure 3-7). The borehole location was on a berm approximately 2.4 m (8 ft) above the ground surface in the Tank Farm. As a result, the original land surface elevation corresponds to a depth of 2.4 m (8 ft) bgs in the borehole. In the subsequent discussions, the depths have been adjusted to correspond to the Tank Farm land surface and not that of the berm.

Fifteen split-spoon samples were collected from borehole CPP-70-1 and screened in the field for gross beta-gamma radiation. Seven samples were selected from the zones having the highest radiation for further analysis. Two of the soil samples admitted for analysis were duplicates collected between 7.3 to 8.5 m (24 to 28 ft) bgs[a] and one sample collected from 10 to 10.4 m (33.5 to 34.0 ft) bgs was too radioactive to be transported offsite. The one sample had a contact surface radiation level of 400 R/hour beta-gamma. During drilling at a depth of 9.4 m (31 ft), the drill cuttings yielded a sharp increase in

[a] Depths given are from the Tank Farm ground surface (i.e., 8 ft shallower than reported depths that were from the berm).

radioactivity (more than 10,000 cpm above background). The four remaining samples were analyzed for VOCs, mercury, cadmium, nitrate/nitrite, pH, and radionuclides.

All samples were analyzed for gross alpha- and gross beta-emitting radionuclides, with the exception of the deepest sample, which was too radioactive to analyze. Samples collected above 8.5 m (28 ft) bgs had relatively low activities of radionuclides, consistent with a release of WCF and NWCF decontamination solutions. Gross alpha activity was below background levels in samples collected below 5 m (16 ft) bgs and above 8.5 m (28 ft) bgs. Gross beta and Cs-137 activities remained above background levels from 4 to 6.7 m (14 to 22 ft) bgs. The soil samples collected from 7.3 to 8.5 m (24 to 28 ft) bgs contained radionuclides near or below background levels.

The highest gross alpha, beta, and Cs-137 activities were from the sample collected from 4.3 to 4.9 m (14 to 16 ft) bgs. The Cs-137 concentration in this sample was 20.9±1.5 pCi/g, the Sr-90 activity was 54.4±3.46 pCi/g. This sample also had detectable levels of U-238 and U-235 near background levels and Pu-238 and Pu-239 slightly above background concentrations.

The radionuclide analysis of the sample collected from 9.8 to 9.9 m (32 to 32.5 ft) bgs measured significantly higher gross alpha (8.09E+5±9.71E+4 pCi/g) and beta (1.89E+7±1.52E+6 pCi/g) activities than were measured in sample intervals above 7.3 m (24 ft) bgs. Isotopic analysis of this soil also detected significantly higher concentrations of Cs-137 (3.37E+7±1.06E+6 pCi/g), Sr-90 (5.41E+6±4.91E+3 pCi/g), and Am-241 (1.66E+4±2.18E+3 pCi/g) activities than in shallower sample intervals. The analysis led investigators to conclude that the deeper contamination is not from the reported WCF and NWCF decontamination solutions associated with site CPP-79. The deeper zone of contamination appears to be the result of a release of high-level liquid, possibly contaminant migration from site CPP-28.

Information on the lateral extent of the contamination around borehole CPP-79-1 is provided by the results of samples from boreholes A-61 and A-62 (LMITCO 1995). These boreholes were drilled to the west and east, respectively, of Borehole CPP-79-1 (Figure 3-5). Based on the sample results for boreholes A-61 and A-62, contamination associated with site CPP-79 has extended as far as borehole A-61 on the west.

Boreholes A-61 and A-62 were drilled to the west and east of borehole CPP-79-1, respectively. Soil samples were collected and analyzed from depths of 8.7 to 9.3 m (28.5 to 30.5 ft) and 11.7 to 12.3 m (38.5 to 40.3 ft) in borehole A-61. The highest gross alpha (1,230±20 pCi/g), gross beta (20,500±50 pCi/g), Sr-90 (3,360±30 pCi/g), and Cs-137 (25,000±2,000 pCi/g) concentrations were in the 8.7- to 9.3-m (28.5- to 30.5 ft) sample from borehole A-61. Other radionuclides detected in this sample include Am-241 (46±4 pCi/g), Pu-239/240 (319±10 pCi/g), and U-234 (2.1±0.1 pCi/g). Concentrations of these same constituents in the 11.7- to 12.3-m (38.5- to 40.3-ft) sample were one to four orders of magnitude lower than in the shallower sample.

Samples were obtained from 0.6 to 1.2 m (2.0 to 4.0 ft) and 12.3 to 12.7 m (40.3 to 41.8 ft) in borehole A-62. Concentrations of Sr-90 and Cs-137 in the near surface soil sample from borehole A-62 were 305±3 pCi/g and 730±5 pCi/g, respectively. Concentrations of these radionuclides were below background in the deeper sample from borehole A-62.

Because the spill at site CPP-79 was a spill from a known source, the source term can be bounded based on knowledge of the volume of liquid lost and knowledge of the generating waste stream. The estimated curie content is 42 Ci.

3.1.1.15.2 Contaminant Summary—Site CPP-79 was evaluated in the OU 3-13 RI/BRA. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-1 RI/BRA are Am-241, Cs-137, Pu-238, Pu-239, Sr-90, U-234, and U-235 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.1.15.3 Characterization Uncertainty—Little uncertainty is associated with site CPP-79 because the spill at CPP-79 was a spill from a known source. The source term can be bounded based on knowledge of the volume of liquid lost and knowledge of the generating waste stream. The estimated curie content is 42 Ci.

3.1.1.16 Site CPP-96 Description. Site CPP-96 incorporates Tank Farm soil sites as defined in the OU 3-14 SOW: CPP-15, CPP-20, CPP-25, CPP-26, CPP-27, CPP-28, CPP-31, CPP-32, CPP-33, CPP-58, CPP-79, and CPP-96, as well as three Tank Farm soil sites: CPP-16, CPP-24, and CPP-30 that were screened out for further action in the OU 3-13 RI/FS. In the OU 3-14 ROD, all Tank Farm soils and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites were consolidated into CPP-96 to facilitate selection of remediation alternatives for the entire Tank Farm. The three no further action sites were assigned to OU 3-14 in the OU 3-13 ROD because with the consolidation of all Tank Farm soil and sites within CPP-96, these three sites are subject to the interim action specified for the Tank Farm in the OU 3-13 ROD and OU 3-14 RI/FS activities. The interim action relies on institutional controls with surface water control to reduce surface water infiltration into Tank Farm soil.

3.1.1.16.1 Data Review—Data on known Tank Farm releases that are incorporated into site CPP-96 are presented in the previous subsections for each site. The backfill soil used throughout the Tank Farm area during maintenance and construction activities has not been characterized for contaminants. Backfill soil typically had an activity level of 3 to 5 mR/hour.

3.1.1.16.2 Contaminant Summary—The contaminant summaries for the sites incorporated into site CPP-96 are presented in the previous subsections for each site. Where the backfill soil has not been sampled, no summary of backfill contaminants is provided.

3.1.1.16.3 Characterization Uncertainty—Further definition of areas of contaminated soil, used as backfill for Tank Farm activities, and of levels of contaminated material are needed for risk assessment and source evaluation. The characterization uncertainties with site CPP-96 are summarized below as a composite of all the uncertainty issues related to the incorporated sites discussed previously:

- Site characterization
- Radiation activity levels
- Release locations
- Source of release
- Quantity of contamination released
- Source volume released

- Spatial extent of contamination
- Source term.

3.1.2 Injection Well and Aquifer within INTEC Security fence Contaminant Sources

3.1.2.1 Service Waste Discharges. The INTEC injection well (site CPP-23), located north of building CPP-666 (see Figure 3-10), was used to discharge INTEC service wastewater, which contained low-level radioactive waste and chemical waste, to the aquifer from 1952 to February 1984 when it was taken out of service. This injected wastewater subsequently contaminated the aquifer within the INTEC security fence and south.

3.1.2.2 Accidental Discharges. During the operational life of the injection well (1952 to 1984), known accidental discharges to the injection well occurred and are described below (WINCO 1994a):

- **July 1953**—The contents of a tank were discharged to the wastewater flowing to the well. A post discharge analysis showed that 51 mCi of radioactive contaminants were released in 923,640 L (244,000 gal.) of water.
- **December 1958**—About 29 Ci of radioactive contaminants, including 7 Ci of Sr-90 were released to the well.
- **September 1969**—Two separate releases resulted in 19 Ci of fission products released to the well. Releases included Cs-137, Cs-134, Ce-144, and Sb-125 in 12.4×10^6 L (3.28×10^6) of wastewater.
- **December 1969**—Two releases occurred in which the quantity of Sr-90 released was higher than expected. About 1 Ci, including 30% Sr-90, was released.
- **March 1981**—Mercury was detected during routine monitoring of the INTEC service waste system. Mercury in the form of mercuric nitrate was released from processing operations in building CPP-601, through the INTEC service waste system to the injection well. An estimated 0.207 mg/L of mercury was detected in service waste. The Resource Conservation and Recovery Act (RCRA) EP toxicity limit for mercury is 0.2 mg/L (40 CFR 61.24, Table 1).

3.1.2.3 Injection Well Contaminants. In 1989, the injection well was sealed by perforating the casing throughout and pumping in cement. Based on a comparison to drinking water standards, the most significant radionuclides in the service wastewater were H-3 and Sr-90. According to the Track 2 investigation (WINCO 1994a), it is estimated that a total of 22,200 Ci, approximately 96% consisting of H-3, has been released in 4.2E+10L (1.1E+10 gal) of water. A complete historical summary of the well is presented in Section 2 of this document. The information in subsequent subheadings summarizes the known contamination (WINCO 1992c, 1994a).

3.1.2.3.1 Data Review—Before the well abandonment, a sediment (sludge) sample was collected in 1989 from the bottom of the open part of the well (about 145 m [475 ft] bgs). Low concentrations of inorganic compounds, radionuclides, and polychlorinated biphenyls (PCBs) were detected. Fourteen inorganic compounds were detected. The concentration of barium (0.26 mg/L) was well below the regulatory threshold of 100 mg/L. The radionuclide analyses of the sediments show that

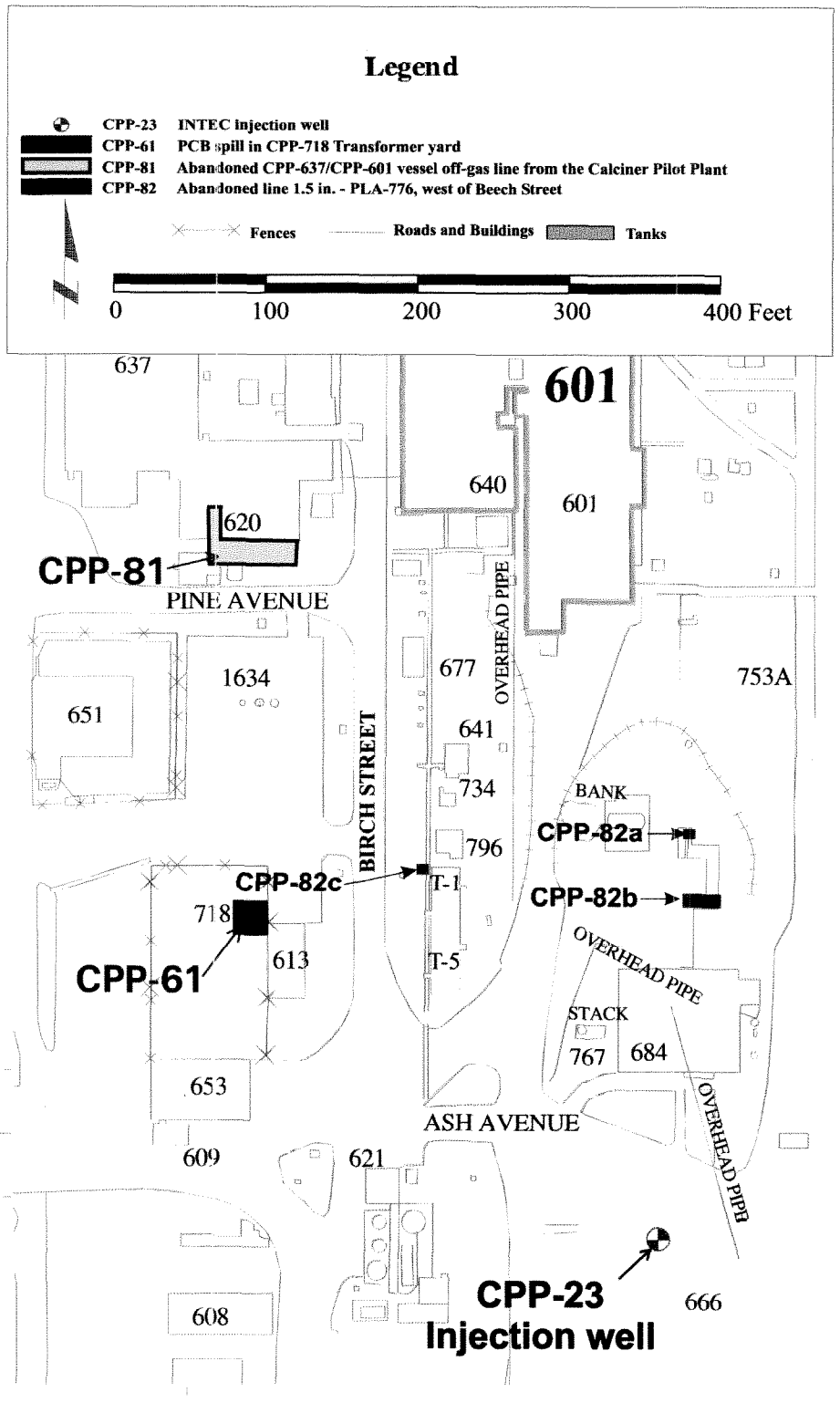


Figure 3-10. Location of INTEC injection well site, CPP-23, and additional soil sites from OU-3-13 (CPP-61, CPP-81, CPP-82).

the gross beta activity was measured at 150 pCi/g. This analysis also measured Cs-137 at 100 pCi/g, Eu-152 at 3.8 pCi/g, and Eu-154 at 2.5 pCi/g. The only organic compound detected above the MDL was Aroclor-1260 at 10 µg/kg (WINCO 1990).

Sampling results in 1993 indicated that the primary contaminants in the aquifer related to the injection well are H-3, Sr-90, and Cs-137. In 1993, Sr-90 concentrations were above the maximum contaminant level (MCL) of 8 pCi/L in an area that extended approximately 2,130 m (7,100 ft) downgradient of the injection well. The plume of H-3 above the MCL of 20,000 pCi/L extended about 2,730 m (9,100 ft) downgradient. Cs-137 concentrations have degreased significantly since the early 1980s. During 1982 to 1985, maximum concentrations in wells U.S. Geological Survey (USGS)-40 and -47 were 237 ± 45 and 200 ± 50 pCi/L, respectively. Between 1986 and 1993, Cs-137 has been detected only one time in each of these wells (WINCO 1994a).

3.1.2.3.2 Contaminant Summary—Where the remaining source of contamination from site CPP-23 is the 120-ft column of sediment remaining in the well (see Figure 2-12), the OU 3-13 RI/BRA assumed that the contaminants detected in the sediment sample at 145 m (475 ft) are representative of the entire vertical interval of the sludge plug. The volume of sludge in the well was estimated at 10.9 m^3 (386 ft^2). The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-13 RI/BRA include osmium, Cs-137, Eu-152, Eu-154, Sr-90 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

3.1.2.3.3 Characterization Uncertainty—Characterization of the residual contamination present in the 120-ft column of sludge inside the well, of residual contamination in SRPA materials, of contamination present in the aquifer as a result of slow-moving plumes of contaminants, and of contamination potentially migrating to the aquifer from other OU 3-13 and 3-14 sources is needed for risk assessment and source evaluation. The characterization uncertainties with site CPP-23 are summarized below:

- Site characterization (sludge, residual SRPA materials, slow-moving contamination plumes, other OU 3-14 sources)
- Radiation activity levels
- Source of releases
- Quantities of contamination released
- Source volumes released
- Spatial extent of contamination
- Source terms.

3.1.3 Additional Sites (CPP-61, CPP-81, and CPP-82) Contaminant Sources

The three sites (CPP-61, CPP-81, and CPP-82) located within the INTEC boundary but outside of the Tank Farm boundary, were screened as no further action sites in the OU 3-13 RI/FS. They were assigned to OU 3-14 ROD because U. S. Department of Energy, Idaho Operations Office (DOE-ID), U.S. Environmental Protection Agency (EPA), and Idaho Department of Environmental Quality (IDEQ)

determined that data for the sites, used in the OU 3-13 RI/FS, were inadequate to select remediation alternatives for the sites.

3.1.3.1 Site CPP-61 Description

Site CPP-61 is an area within the CPP-718 transformer yard where a PCB oil spill occurred in the early 1980s (Figure 3-10). The transformer yard is approximately 29 × 47 m (95 × 155 ft) in area and is surrounded by a 2.4 m (8 ft) tall cyclone fence. The spill occurred during the utilities replacement and expansion project (UREP) when the transformer had to operate with a 30–40% voltage overload. As a result of the voltage overload, heat expansion of the transformer oil caused a leak to occur in one of the transformer fittings. Approximately 1,510 L (400 gal) of PCB oil was spilled. The PCB concentration in the oil was 179 ppm. Most of the spill was contained; however, some spilled oil contaminated the surrounding soil (WINCO 1992a).

3.1.3.1.1 Data Review—In July 1985 the spill area was cleaned up. The transformer, contaminated soil, and the pad were removed and shipped to a commercial disposal facility and approximately 40 drums of soil and debris were removed. A new transformer and concrete pad have been installed over the site.

As part of the cleanup, an excavation is reported to have been completed to a depth of 1.8 m (6 ft). The excavation was subsequently backfilled with soil previously removed from portions of the CPP-718 transformer yard. Analysis of the backfill soil showed PCB concentrations up to 10 ppm. In addition, documentation and analytical results suggest that an area of residual surface radioactive contamination remains adjacent to the excavated area.

Before removal of the contaminated soil associated with the PCB release, surface radiological contamination was detected by INTEC radiological control personnel. Nine surface hotspots were surveyed in the area ranging between 400 and 2,500 cpm above a 200-cpm background level, including hotspots of 1,000 and 1,500 cpm near the PCB release. No source for the radiological contamination was identified.

A Track 1 investigation resulted in a no further action recommendation that was approved in January 1993 for the PCB release. This recommendation included further evaluation of the low-level radioactively contaminated soils discovered at the site (WINCO 1992a).

As part of the WAG 3 RI/FS field sampling program, a surface radiation survey was conducted to aid in sample location selection. Hand augered boreholes were completed at the location of the three highest radiation readings obtained during the surface radiation survey. These hand augered boreholes are CPP-61-2, CPP-61-3, and CPP-61-4. Surficial soil samples from a depth interval of 0 to 0.15 m (0 to 0.5 ft) were collected at each borehole, along with samples from the 0.15-m (0.5-ft) increment below the surficial sample that returned the highest radiation reading.

One borehole, designated as location CPP-61-1, was drilled to a depth of 3 m (10 ft). Borehole CPP-61-1 was located as close as possible to the original PCB spill and the locations of the 1,000 and 1,500 cpm readings detected during the 1985 radiation survey. Samples were collected from 0 to 0.15 m (0 to 0.5 ft), 0.6 to 1.2 m (2 to 4 ft), and 2.4 to 3.0 m (8 to 10 ft). The 0.6- to 1.2-m (2- to 4-ft) sample represented the sample in the 0.15- to 1.2-m (0.5- to 4-ft) interval with the highest field radiation reading. The same criteria were used to select the 2.4- to 3.05-m (8- to 10-ft) sample from the 1.2- to 3.0-m (4- to 10-ft) interval.

The radionuclides Cs-137, Sr-90, and Tc-99 ranged from maximum activities of 2.51±0.07, 3.0±0.2, and 1.6±0.5 pCi/g, respectively, to minimum values of 1.69±0.06, 0.9±0.2, and 1.3±0.4 pCi/g, respectively. Radionuclide detections above background in below-surface samples were limited to Cs-137 (1.1±0.5 pCi/g) in the 0.15- to 0.3-m (0.5- to 1.0-ft) sample at borehole CPP-61-3 and Tc-99 at 1.9±0.4 and 1.5±0.4 pCi/g in the 0.6- to 1.5-m (2.0- to 4.0-ft) and 2.4- to 3.0-m (8.0- to 10.0-ft) intervals in the borehole CPP-61-1.

3.1.3.1.2 Contaminant Summary—Site CPP-61 was evaluated in the OU 3-13 RI/BRA. Because of the limited extent of soil with radiation levels above background, site CPP-61 is considered a site of negligible soil contamination. The retained OU 3-13 contaminants from the contaminant screening process in the OU 3-1 RI/BRA are Sr-90, Tc-99, and Cs-137 (DOE-ID 1997a, Section 5.2). Section 3.1.4 summarizes the contaminants at the OU 3-14 sites. Section 3.2 summarizes the risk assessment results from the OU 3-13 RI/BRA that are relevant to the Tank Farm soil and aquifer beneath INTEC.

The decision to carry site CPP-61 over to OU 3-14 for further evaluation was based on the uncertain amount of PCB contamination that may remain under the concrete pad. Therefore, PCB has been added to the list of potential contaminants of potential concern (COPCs) for site CPP-61 (DOE-ID 1999a).

3.1.3.1.3 Characterization Uncertainty—The characterization uncertainties with site CPP-61 are summarized below:

- Site characterization
- Spatial extent of contamination
- Source term.

3.1.3.2 Site CPP-81 Description. Site CPP-81 is an abandoned vessel off-gas (VOG) line (VGA-100; CPP-637/CPP-601 VOG line) from the 30-cm (12-in.) diameter calciner pilot plant (see Figure 3-10). The 7.6-cm (3-in.) line, located approximately 0.6- to 0.9-m (2- to 3-ft) bgs, contained simulated calcine that became plugged in the line following a 1986 test run. A 20.7-m (68-ft) section of the line was abandoned, with most of the line being under a concrete floor at the south end of the chemical engineering laboratory (CPP-620). During the fall of 1993, the line was cleaned as part of a time-critical removal action (WINCO 1994b). The line was flushed with hot acid to remove the simulated calcine. No leaks were observed during the removal action, indicating that no previous release to the environment had occurred. The final water rinse was analyzed and found to not contain contaminants above toxicity characteristic leaching procedure (TCLP) limits. A portion of the line was removed in 1993, probably about 3 to 4 ft, and both remaining pipe ends have blind flanges on them (DOE-ID 1997a; McCray 2000). The rest of the line, under a concrete floor at the south end of CPP-620, was abandoned.

The site was approved as a no further action in the Track 1 investigation and was not evaluated in the OU 3-13 RI/BRA. The DOE-ID, EPA, and IDEQ have determined that Site CPP-81 will be transferred to OU 3-14 for further evaluation because of the lack of sufficient data to make a final remediation decision (DOE-ID 1999a).

3.1.3.2.1 Data Review—No release to the environment is believed to have occurred. No samples were collected (WINCO 1994b).

3.1.3.2.2 Contaminant Summary—The site was approved as a no further action in the Track 1 investigation and was not evaluated in the OU 3-13 RI/BRA (DOE-ID 1997a).

3.1.3.2.3 Characterization Uncertainty—The characterization uncertainties with site CPP- 81 are summarized below:

- Site characterization
- Radiation activity levels
- Quantities of contamination released, if any
- Source volumes released, if any
- Spatial extent of contamination, if it exists
- Source terms.

3.1.3.3 Site CPP-82 Description. Site CPP-82 (see Figure 3-10) is the location of three wastewater spills (designated sites A, B, and C) caused by the rupturing of previously abandoned underground lines. The lines were ruptured during excavation activities. Site A, located east of building CPP-797, is where the abandoned line, 1-1/2"-PLA-776, located west of Beach Street was damaged and released an estimated 9.4 L (2.5 gal) of low-level radioactive waste into the soil. The abandoned line and contaminated soil associated with the leak were removed and disposed of during maintenance repairs. Sites B and C are associated with spills of non-radioactive, nonhazardous wastewater. These spills occurred during the repair activities associated with site A. The contamination was removed after the release. Site B is located south of building CPP-797 and is an area where underground piping was damaged during excavation of PLA-776. It was determined the damaged line did not carry any hazardous materials. Site C is located west of CPP-T1 and is the site of two ruptured plastic lines. It was determined that the line did not carry any hazardous material. Sites B and C are associated with spills of non-radioactive, nonhazardous wastewater. These spills occurred during the repair activities associated with site A. This site was recommended and approved as a no further action site in the Track 1 investigation (WINCO 1992b) and was therefore not retained for the OU 3-13 BRA. The DOE-ID, EPA, and IDEQ have determined that site CPP-82 will be transferred to OU 3-14 for further evaluation because of the lack of sufficient data to make a final remediation decision (DOE-ID 1999a).

3.1.3.3.1 Data Review—At site A, the abandoned line (1-1/2"-PA-776) and contaminated soil associated with the leak were removed and disposed during maintenance repairs. It is not known if samples were collected. At Sites B and C, the spills were stated as non-radioactive and nonhazardous and the contaminated soil was removed after the release. It is not known if samples were collected (WINCO 1992b).

3.1.3.3.2 Contaminant Summary—The site was approved as a no further action in the Track 1 investigation and was not evaluated in the OU 3-13 RI/BRA (DOE-ID 1997a).

3.1.3.3.3 Characterization Uncertainty—The characterization uncertainties with site CPP- 82 are summarized below:

- Site characterization
- Radiation activity levels
- Quantities of contamination released (sites B and C)
- Source volumes released (sites B and C)

- Spatial extent of contamination
- Source terms.

3.1.4 Summary of OU 3-14 Site Contamination Based on the OU 3-13 RI/FS

A curie estimate for the contaminated backfill, used at the Tank Farm and not associated with earlier release sites, has not yet been prepared. This will be part of the OU 3-14 Tank Farm investigation. Based on past characterization, the two sites, CPP-28 and CPP-31, contain 99% of the estimated surface source curie inventory, and CPP-15 contains 1% of the curie inventory.

The contaminants in the column of sludge remaining in the injection well were not fully characterized. The OU 3-13 RI/BRA assumed the sediment sample from 145m (475 ft) would be representative of the contaminants in the sludge. The OU 3-14 investigation involves reopening the injection well to obtain a core sample to determine the contamination in the sludge and in the vicinity surrounding the well where the casings were breached.

Based on historical information and professional judgement, the soil sites outside of the Tank Farm (sites CPP-61, CPP-81, and CPP-82) probably have significantly less than 1% of the curie inventory estimated for the Tank Farm. However, further evaluation of these sites will be performed because of a lack of sufficient data to make a final remediation decision.

The contaminants retained from the OU 3-13 chemical screening process for the sites being addressed under OU 3-14 are presented in Table 3-1. As indicated in the table, some are the contaminants determined from historical process or environmental release information on a given site.

3.2 OU 3-13 Risk Assessment Summary

The OU 3-13 Remedial Investigation (RI) (DOE-ID 1997a) presented the available data for WAG 3 concerning site conditions and the nature and extent of contamination as of 1997. The RI examined 92 of the then known 94 designated release sites (CPP-84 and CPP-94 were not investigated in the RI/BRA) and the windblown area for human health and ecological receptors. Because OU 3-14 concerns the risk assessment results only for the Tank Farm surface soil pathway and the groundwater pathway beneath the INTEC security fence, only those applicable portions of the OU 3-13 RI/BRA are summarized here. The OU 3-13 contaminants of concern (COCs) identified for both the soil and groundwater pathways are derived from the OU 3-13 COPCs developed for each release site.

3.2.1 Summary of the OU 3-13 Tank Farm Surface Soil Pathway

The results of the OU 3-13 RI/BRA indicate that the potential exists for adverse health effects from exposure to the Tank Farm soils contaminated with Cs-137, Eu-154, U-235, and Sr-90. Limited site characterization was conducted at the Tank Farm during the OU 3-13 RI/FS (DOE-ID 1997a, 1997b) primarily because the Tank Farm is an active operational facility. Assumptions about the horizontal and vertical distribution of contaminated soils were made to calculate the area-weighted soil concentrations; however, the boundaries of the release sites are not well known. Assumptions about the concentration in the perched water are of concern because perched water potentially contributes to elevated concentrations

in the SRPA.[b] The OU 3-13 FS Supplement (DOE-ID 1998a) presented important characteristics about the Tank Farm soils such as the contaminated area, OU 3-13 COCs, preliminary remedial goals (PRGs), and the required period of performance for each site. The characteristics are summarized in Table 3-2 (DOE-ID 1998a).

As shown in Table 3-2, the primary risk contributors (i.e., the OU 3-13 COCs) identified in the OU 3-13 RI/BRA for the Tank Farm surface soils were Cs-137, Eu-154, Pu-238, Pu-239/240, Pu-241, Sr-90, and U-235. Though plutonium did not present an unacceptable risk, it was added to the OU 3-13 COC list because of the uncertainty in the amount of plutonium released in the Tank Farm area. The uncertainty in the distribution of contaminants in the surface soils stems from the lack of documentation of all of the potential historical contaminant releases that may have occurred at the Tank Farm and limited site characterization during the OU 3-13 field investigation.

3.2.2 Summary of the OU 3-13 Groundwater Pathway Modeling and Risk Assessment

There are two sources of existing or future contamination in the SRPA. These include (1) the historical use of the injection well and (2) the surface soil sources leaching through the vadose zone into the perched water and subsequently into the SRPA. The OU 3-13 BRA simulated the vadose zone-aquifer-groundwater system at the INTEC. Simulations were performed to predict water infiltration and transport through the vadose zone. The predicted water and contaminant mass fluxes from the vadose zone model were then used as input to a separate aquifer model.

Predictions of contaminant transport from land surface to the SRPA and south to the INEEL boundary were focused on obtaining future groundwater concentrations in the year 2095 to support the 100-year risk scenario (DOE-ID 1996) for the WAG 3 comprehensive BRA (DOE-ID 1997a) and evaluating potential health impacts to a hypothetical future resident.

The risks calculated for the SRPA are risks on the INEEL site. No projections of impact off the INEEL site have been completed for downgradient SRPA users. Concentrations were reported as a function of time over a simulation period extending well beyond 2095 until the peak concentrations were identified. In the contaminant transport analysis of groundwater, all Tank Farm release contaminants were assumed to move immediately from the surface soil to the underlying basalt after release from a Tank Farm facility.[c] (The tank farm known releases account for the majority of the contamination to the environment.) This assumption was conservative for the groundwater pathway because it maximizes concentrations and reduces transit time.

b. The OU 3-13 ROD (DOE-ID 1999a), has a selected remedy for the perched water—institutional controls with groundwater recharge control to mitigate further migration of the contaminants to the aquifer.

c. Only the Tank Farm contaminant releases from sites CPP-28 and CPP-31, and a 1986 release were used as surficial sediments in the model sediments. The other soil contamination is assumed to be in the surficial sediments (DOE-ID 1997a).

Table 3-2. Summary of OU 3-13 Tank Farm surface soil release sites, OU 3-13 contaminants of concern, and preliminary remediation goals (DOE-ID 1998a).

Release Site	Area[a] (ft^2)	Major Contaminants of Concern	Preliminary Remediation Goal (pCi/g)	Time Required to Achieve PRG[b] (years)
CPP-15	700	Cs-137	23	443
CPP-20	225	Cs-137	23	173
CPP-25	500	Cs-137	23	173
CPP-26	12,850	Cs-137	11.5	360
		Sr-90	111	120
CPP-27/-33[c]	2,000	Cs-137	23	293
CPP-28/-79[d]	4,950	Cs-137	4.6	781
		Eu-154	1,040	172
		Pu-238	134	880
		Pu-239/240	50	137,000
		Pu-241	11,200	174
		Sr-90	44.5	464
CPP-31	10,550	Cs-137	4.6	575
		Pu-239/240	50	50,800
		Sr-90	44.5	268
		U-235	2.6	6.4 billion
CPP-32[e]	14	Cs-137	23	223
CPP-58[f]	6,800	Cs-137	23	147
CPP-96 (additional soils)[g]	79,696	Unknown	Unknown	Unknown

a. All of the release-site areas were obtained from the OU 3-13 RI/BRA (DOE-ID 1997a, Figures 9-1 and 10-1) except for the contaminated soil stockpile, which was surveyed, and the area of additional soils, which was estimated in the OU 3-13 feasibility study (DOE-ID 1997b).
b. The time required to achieve the PRGs, which are risk-based concentrations (RBCs), was obtained from Burns (1997). This column refers to the amount of time required for the contaminants of concern to decay naturally to an activity less than the 1E-04 RBC. The RBC corresponds to a concentration that yields a 1E-04 incremental lifetime cancer incidence risk.
c. Sites CPP-27 and CPP-33 are considered together because they derived from the same transfer line leak and were considered together in the OU 3-13 RI/BRA and all Track 2 investigations.
d. Sites CPP-28 and CPP-79 are considered together because an area of high concentration is contained within CPP-79 that probably originated from site CPP-28 (see Section 7.3.1.1).
e. This site was formerly designated as CPP-32W. It was combined with a similar site, CPP-32E, and designated as CPP-32.
f. This site is designated as CPP-58E and 58W, which represent the eastern and western portions of the site. The eastern portion originated from a spill and the western portion from a leak, both from the same source.
g. Site CPP-96 refers to surface soils surrounding the Tank Farm vaults that are assumed to be contaminated because of the uncertainty in the Tank Farm site characterization. The volume of additional soils was estimated using the excavation footprint shown in the OU 3-13 FS (DOE-ID 1997a, Figure 5-1) less the volume occupied by the tank vaults and the soil volumes at known release sites. The soils surrounding the tank vaults were assumed to be contaminated to a depth of 12 m (40 ft).

The determination of the OU 3-13 COPCs for the groundwater pathway are discussed in Section 5.2 of Appendix F of the OU 3-13 RI/BRA (DOE-ID 1997a). Table 3-3 presents the OU 3-13 COPCs that were evaluated for the groundwater pathway. These include the three non-radionuclides (arsenic, chromium, and mercury) and the ten radionuclides (Am-241, Co-60, Cs-137, H-3, I-129, Np-237, Sr-90, Tc-99, total Pu, and total U). These originate either at the land surface (current soil inventory), historical waste process water discharge streams (i.e., service waste ponds or percolation ponds), accidental releases, and/or past use of the injection well. The injection well source includes the period during which the well failed and introduced contamination to the vadose zone rather than the SRPA. In addition, because the Test Reactor Area (TRA) and INTEC contaminant plumes could overlap down gradient, the two primary contaminants identified in the TRA RI (Cr and H-3) were included as aquifer source terms.

Concentrations were reported as a function of time over a simulation period extending well beyond 2095 to identify peak concentrations. The OU 3-13 BRA determined a simulation time of 3804 years where the peak total plutonium concentration was identified (in the year 3585). Table 3-4 summarizes the maximum and peak concentrations at various periods in time. Based on the information in this table, the following conclusions can be drawn:

- Arsenic, Co-60, Cs-137, Tc-99, total U and Am-241 have not and are not expected to exceed their MCL and risk-based concentration (RBC) (target risk=1E-04).

- Chromium, tritium, and Np-237, exceed their MCL or the RBC before the year 2095 but not after 2095. Therefore, these contaminant concentrations will not pose an unacceptable risk to future residents.

- Mercury, I-129, Sr-90, and total plutonium exceed their MCL or RBC before 2095 (except total plutonium) and also after 2095. These contaminants are predicted to pose an unacceptable risk to the future residents (see Table 3-5).

Contaminant discharges to the INTEC injection well, site CPP-23, are the primary contributors to the aquifer peak concentrations of mercury, I-129, Sr-90, and total plutonium (see Table 2-5). From an interpretation of the OU 3-13 RI/BRA results (DOE-ID 1997a, Section 6.6), it is possible to identify the source that led to the contaminant plumes of interest that exceed MCLs or the RBC.

- For mercury, interpretation indicates that the INTEC injection well is the main source

- The primary I-129 flux to the aquifer was from direct input of injection well sources into the aquifer

- For Sr-90, the injection well is most of the pre-2095 contribution, but after 2095, the vadose zone contribution is more significant

- For total plutonium, the injection well is the early contributor, but later in time the contribution from the vadose zone becomes most significant.

The I-129 surface sources represent a small contribution (less than 9%) to the OU 3-13 BRA aquifer peak concentration as compared to the injection well sources of I-129. The peak aquifer concentration and the mass flux to the aquifer from surface soil sources do not correlate. This Work Plan should confirm the I-129 concentration levels in the vadose zone resulting from the injection well failure or another source. Once the I-129 concentration levels are known, a decision can be made on whether to further evaluate I-129 as a surface contaminant contributing to the groundwater risk.

Table 3-3. Summary of the identified groundwater COPCs for OU 3-13 (DOE/ID 1999a).

OU 3-13 COPCs Based on Water Samples				
Aquifer Based COPCs	Additional COPCs Based on Perched Water	Additional COPCs Based on Soil Contamination	Additional COPCs Based on Other Considerations	Final List of the COPCs for the Groundwater Pathway
Am-241	None	Arsenic	Cs-137	Arsenic
H-3		Chromium	Mercury	Chromium
I-129		Co-60		Mercury
Np-237		U-235[a]		Am-241
Sr-90		Pu-238[a]		Co-60
Tc-99		Pu-239[a]		Cs-137
U-234[a]		Pu-240[a]		H-3
U-238[a]				I-129
				Np-237
				Total plutonium[a]
				Sr-90
				Tc-99
				Total uranium[a]

a. The isotopes were identified as COPC, but in the OU 3-13 modeling, they were lumped together and simulated as totals.

Stronium-90 currently exists in the perched water from soil sources in levels that greatly exceed both MCLs and risk limits. Perched water is not a potable drinking water source because of the relatively sparse lateral extent of saturated regions existing in low permeability regions, which lead to insufficient deliverability (low flow rates) of water for domestic use. However, the Sr-90 concentration in the perched water is of concern because it potentially contributes to elevated concentrations in the SRPA.

The estimated activity of total plutonium (i.e., Pu-238, Pu-239, Pu-240, and Pu-241) released to the environment was 1,190 Ci. Of this total, 1,180 Ci (99%) was released from the Tank Farm. The transport model conservatively assumed that the entire Tank Farm release of plutonium moved immediately from the Tank Farm soil to the underlying basalts and down to the perched water. This Work Plan should confirm the movement of OU 3-13 COPCs (to be determined after sampling) through the Tank Farm soil to the aquifer. Though plutonium did not present an unacceptable risk to receptors within the 100-year timeframe assessed in the OU 3-13 RI/BRA, the model indicated that plutonium peaks with an aquifer concentration of 36.2 pCi/L in the year 3585, and it would present an unacceptable groundwater ingestion risk of 2E-04. The peak concentration is more than twice as large as the total allowable alpha activity in drinking water of 15 pCi/L (40 CFR 141). Plutonium-241 and Pu-238 are not considered contaminants of potential concern for the aquifer because the radioactive decay half-lives of 14 and 87 years, respectively, occur before the total plutonium peak concentration is reached in 3585. Only Pu-239 and Pu-240 will remain. Because Pu-239 has a long decay half-life (2.41E+04 yrs) and contributes to the vast majority of the mass, the total plutonium by the year 3585 can be assumed to be all Pu-239.

Table 3-4. Summary of the OU 3-13 maximum and peak simulated contaminant concentrations for the entire aquifer domain[a] (DOE-ID 1997a, 1997b)

OU 3-13 COPC	K_d (cm^3/g)	MCL (mg/L or PCi/L)	1E-04 RBC	Maximum Aquifer Concentration at Year 2025 (mg/L or pCi/l)	Maximum Aquifer Concentration at Year 2095 (mg/L or pCi/L)	Peak Aquifer Concentration After the Year 2095 (mg/L or pCi/L)	Peak Aquifer Concentration Through Total Simulation Time (mg/L or pCi/L)
Arsenic[f]	3	0.05[b]	0.006	9.4E-05	1.2E-03	1.95E-03 (2479)[e]	1.95E-03 (2479)[e]
Chromium[f,g]	1.2	0.1[b]	0.18[c]	0.07	0.03	0.03 (2095)	0.9 (1971)
Mercury[f]	100	0.002[b]	0.003[c]	0.006	0.004	**0.004 (2095)**	**0.007 (1984)**
Total U[f] (inorganic)	6	0.02[b]	0.11[c]	0.003	0.001	0.01(2468)	0.014 (1986)
Co-60	10	100[d]	254	0.03	0.0	0.0 (2095)	25.9 (1986)
Cs-137	500	200[d]	152	32.0	5.9	5.9 (2095)	86.2(1979)
H-3	0	20,000[d]	67,100	4,240.0	89.2	89.2 (2095)	2.6E+06 (1960)
I-129	0	1[d]	26	9.0	4.68	**4.68 (2095)**	**97.1 (1986)**
Np-237	8	<15	16	8.03	3.76	3.76 (2095)	30.5(1986)
Sr-90	12	8[d]	86	35.4	8.08	**16.1 (2172)**	**1,200.0 (1967)**
Tc-99	0.15	900[d]	3,430	55.1	23.9	23.9 (2095)	203.0 (1997)
Am-241[h]	340	<15	15	0.8	0.63	0.63(2095)	0.9 (1986)
Total Pu	22	<15	NA	0.32	0.14	**36.2 (3585)**	**36.2 (3585)**
Total U	6	14	77	2.1	1	7.3 (2468)	10.1 (1986)

a. Entire aquifer domain is area within INTEC and that south of the south security fence.

b. Drinking Water Regulations and Health Advisories, may 1995.

c. Values based on hazard quotient of 1.

d. Water concentration that will result in a dose rate of 4 mrem/yr, if contaminant is only one present, based on an ingestion of 2L/d using ICRP-2 methods.

e. Values in parentheses denotes the year when the peak occurs.

f. Concentrations are provided in mg/L.

g. All peak aquifer concentrations are in and downstream of the TRA area. INTEC area concentrations are significantly lower.

h. Am-241 numbers do not include decay from Pu-241 to Am-241 in this table.

NOTE: Peak aquifer concentrations highlighted in bold text indicate that the value exceeds the respective MCL.

Table 3-5. OU 3-13 groundwater ingestion cancer risk and noncancer hazard quotients in the year 2095 and for the peak concentration if it occurs beyond the year 2095 (DOE-ID 1997a, 1997b, 1998a).

Contaminant	MCL (mg/L or pCi/L)	Predicted Concentration in the Year 2095 (mg/L or pCi/L)	Groundwater Ingestion Cancer Risk or HQ in the Year 2095	Peak Aquifer Concentration If Beyond the Year 2095 (mg/L or pCi/L)	Year of Peak Aquifer Concentration	Peak Aquifer Risk or HQ
Arsenic (mg/L)	5.0E-02	1.25E-03	2E-05 (5E-02)[a]	1.95E-03	2479	3E-05
Chromium[e] (mg/L)	1.0E-01	0.03	0.2[a]	–	–	–
Mercury (mg/L)	2.0E-03	**4.17E-03**	**1.33**[a]	–	–	–
Uranium (inorganic) (mg/L)	2.0E-02	1.31E-03	1E-2[a]	1.0E-02	2468	5.0E-01[a]
Total Am-241[b]	<1.5E+01	8.72E-01	6E-06	–	–	–
Co-60	1.0E+02	0	NA	–	–	–
Cs-137	2.0E+02	5.91E+00	4E-06	–	–	–
H-3	2.0E+04	8.92E+01	1E-07	–	–	–
I-129	1.0E+00	**4.68E+00**[c]	**2E-05**	–	–	–
Np-237	<1.5E+01	3.76E+00	2E-05	–	–	–
Total plutonium	<1.5E+01	1.39E-01	1E-06	**3.62E+01**	3585	**2E-04**
Sr-90	8.0E+00	8.08E+00	9E-06	**1.61E+01**	2172	**2E-05**
Tc-99	9.0E+02	2.39E+01	7E-07	–	–	–
Total uranium	1.4E+01	9.57E-01	1E-06	7.3E+00[d]	2468	7E-06

a. The value given is a hazard quotient.
b. The value includes decay from Pu-241.
c. The value given is based on groundwater modeling assuming a 25-ft open interval for production well. The assumption was made in the OU 3-13 FS Supplement (DOE-ID 1998a) that a 50-ft open interval for the same well resulted in a peak aquifer concentration of 1.41 pCi/L in the year 2106.
d. The value given is for total uranium.
e. All peak aquifer concentrations are in and downstream of the TRA area. The INTEC area concentrations are significantly lower

Note: Peak aquifer concentrations highlighted in bold text indicate that the value exceeds the respective MCL.

Modeling to support the OU 3-13 RI/FS indicated that Tank Farm contaminants released to the soil will cause unacceptable degradation of the SRPA in the future (DOE-ID 1997a, 1997b, 1998a). Specifically, estimated levels of Sr-90 and plutonium in the SRPA were predicted to exceed MCLs in years 2172 and 3585, respectively. Strontium-90 from Tank Farm soils was not expected to reach the aquifer for dozens of years, whereas plutonium isotopes were not expected to reach the aquifer for hundreds of years. The aquifer should not be adversely affected by Tank Farm Sr-90 and plutonium in the timeframe of the OU 3-13 Tank Farm soils interim action (DOE-ID 1999a).

3.3 Contaminant Data Review

3.3.1 Site Screening and Data Compilation

Waste Area Group 3 was initially subdivided into 13 OUs that were investigated for contaminant releases to environmental pathways in accordance with the FFA/CO Action Plan (DOE-ID 1991). During the OU 3-13 RI/FS evaluation (DOE-ID 1997a, 1997b, 1998a) and subsequent remedy development, data gaps were identified and the release sites and OUs were further categorized into seven groups relating to media, similar contamination, or geographic proximity:

- Group 1—Tank Farm soil
- Group 2—Soil Under Buildings and Structures
- Group 3—Other Surface Soils
- Group 4—Perched Water
- Group 5—Snake River Plain Aquifer (SRPA)
- Group 6—Buried Gas Cylinders
- Group 7—SFE-20 Hot Waste Tank System.

Operable Unit 3-14, was created to address those release sites and any other OUs where available information was insufficient to select a final remedy under OU 3-13. Interim actions were developed for implementation in the OU 3-13 ROD with the final remedy relegated to OU 3-14.

Results of the OU 3-13 RI/FS BRA (DOE-ID 1997a) showed that contaminated Tank Farm soil (Group 1) poses an unacceptable risk at the surface pathway. In addition, the Tank Farm soil and the injection well (site CPP-23) (Group 5) were concluded in the OU 3-13 BRA to account for the majority of the contamination potentially threatening the aquifer within the INTEC security fence and future groundwater users.

The Tank Farm soil (Group 1) and SRPA (Group 5) within the INTEC security fence were assigned to OU 3-14 in the OU 3-13 ROD (DOE-ID 1999a) because DOE-ID, EPA, and IDEQ determined that available or collected data from past investigations were inadequate to select remediation alternatives for the sites. Additional INTEC sites consisting of soil sites CPP-61, CPP-81, and CPP-82 also were added to OU 3-14 because not enough data are available to make a risk-based decision to select a final remedial action.

Additional data proposed for collection and analysis during the OU 3-14 remedial investigation include subsurface soil and aquifer contaminant concentrations. The data may be evaluated in an

additional assessment to support remedial decisions for OU 3-14. Analysis could include exposure concentrations from external radiation, ingestion of groundwater, incidental ingestion of soil, and ingestion of homegrown produce.

In summary, Tank Farm soil, and the SRPA are interim actions in the OU 3-13 ROD and are included in OU 3-14 for final remedy selection along with additional soil sites, CPP-61, CPP-81, and CPP-82. Table 3-1 lists the OU 3-14 release sites and their descriptions (DOE-ID 1999a).

3.3.2 Risk Assessment Uncertainties

The work scope presented in this Work Plan is based on the uncertainties identified for the Tank Farm soil, the injection well, and the SRPA within the INTEC security fence, groundwater modeling, and the additional three sites from OU 3-13 (sites CPP-61, CPP-81, and CPP-82). This section presents those identified uncertainty issues. The data collection activities presented in Section 4 are designed to address these issues.

3.3.2.1 Tank Farm Soil. The OU 3-13 ROD (DOE-ID 1999a) determined that the Tank Farm soil represents a risk resulting from direct radiation exposure and leaching and transport of contaminants to the aquifer beneath the INTEC security fence. Because of uncertainties (DOE-ID 1997a, 1997b, 1998a) final remedial alternatives for the Tank Farm soil could not be determined in the OU 3-13 RI/FS. The scoping team comprised of DOE-ID, EPA, and IDEQ project managers and others met in 1998 and 1999 and identified additional data needs for the Tank Farm soil. The major issues are summarized below:

- The spatial extent, type, distribution, quantities, and concentrations of contaminants in the Tank Farm soil are inadequately characterized
- The limited characterization performed at the Tank Farm does not provide sufficient data concerning the contaminated soil volumes that require remediation
- Development of site-specific Tank Farm soil distribution coefficients (K_ds) are required for the OU 3-13 COPCs (to be determined after sampling).
- Moisture flux at the Tank Farm is required to assess contaminant mobility.

3.3.2.2 Injection Well and Aquifer Within the INTEC Security Fence. The OU 3-13 ROD (DOE-ID 1999a) determined that the injection well may represent a risk resulting from leaching and transport of contaminants to the aquifer within the INTEC security fence from the remaining sludge and the contaminated residue forced into the vadose zone during periods when the injection well casing failed. Because of a number of uncertainties (DOE-ID 1997a, 1997b, 1998a), final remedial alternatives for the injection well could not be determined in the OU 3-13 RI/FS. The scoping team comprising DOE-ID, EPA, and IDEQ project managers and others met in 1998 and 1999 and identified additional data needs for the aquifer. The major issues are summarized below:

- The spatial extent, type, distribution, quantities, and concentrations of contaminants in the injection well sludge and nearby aquifer are inadequately characterized
- The limited characterization performed does not provide sufficient data concerning the contaminated volumes and leaching potential to the aquifer
- Development of site-specific Tank Farm soil and injection well sludge (K_ds) are required for the OU 3-14 COPCs (to be determined after sampling)

- Determination of moisture flux at the Tank Farm is required to access contaminant mobility to the aquifer.

3.3.2.3 Groundwater Modeling. The OU 3-13 ROD (DOE-ID 1999a) determined that the aquifer within the INTEC security fence may represent a risk to future groundwater users. Operable Unit 3-13 BRA risk estimates (DOE-ID 1997a) associated with predicted concentrations in the aquifer were deemed unacceptable because of insufficient data and modeling uncertainties. Because of these uncertainties (DOE-ID 1997a; 1997b, 1998a), final remedial alternatives for the aquifer beneath the INTEC security fence could not be determined in the OU 3-13 RI/FS. The scoping team comprising DOE-ID, EPA, and IDEQ project managers and others met in 1998 and 1999 and identified additional data needs for the groundwater modeling. The major issues are summarized below:

- Predicted estimates of concentrations of Pu and Sr-90 in the perched water were too high
- Uncertainty in Tank Farm soil transport calibration
- Lack of moisture monitoring data from the Tank Farm soil
- Recharge uncertainty (i.e., with Tank Farm soil and the Big Lost River)
  - Bounding of infiltration from precipitation
  - Quantification of vertical and horizontal moisture flux though the Tank Farm soil from adjacent recharge sources
  - Extent of the influence of infiltration from the Big Lost River on the Tank Farm soil
- Geochemistry
  - Low pH effluent in line leaks
  - Source release issues
  - K_d issues.

The following issues have been identified to resolve the model uncertainties mentioned above:

- Tank Farm soil geochemistry
- Site-specific Tank Farm soil, injection well sludge distribution coefficients (K_ds) for the OU 3-13 COPCs (to be determined after sampling), and the poorly understood contaminant mass source terms are required to assess contaminant mobility
- Calculation of moisture flux at the Tank Farm is required to assess contaminant mobility
- The spatial extent, type, distribution, quantities, and concentrations of contaminants in the Tank Farm soil are not sufficiently characterized to define the risk to the aquifer inside the INTEC security fence
- The spatial extent, type, distribution, quantities, and concentrations of contaminants in the injection well sludge and nearby aquifer are not sufficiently characterized to define the risk to the aquifer inside the INTEC security fence

- The extent of contaminants of potential concern in the HI interbed (at a depth of 158.5 to 167.6 m [520 to 550 ft]) and its ability to migrate from the interbed.

3.3.2.4 Additional Sites CPP-61, CPP-81, and CPP-82. The DOE-ID, EPA, and IDEQ determined in the OU 3-13 ROD (DOE-ID 1999a), that sites CPP-61, CPP-81, and CPP-82 will be further evaluated under OU 3-14 because inadequate data exist to select a final remedy for the sites. The major issues are summarized below:

- The spatial extent, type, distribution, quantities, and concentrations of contaminants remaining at these sites are inadequately documented or characterized

- The documentation or characterization performed at these sites does not provide sufficient data concerning the contamination or contaminated soil volumes that still remain and may require remediation.

- Although these sites require further evaluation, it is anticipated that a final decision can be reached based on documented historical information. These historical documents will be used, if needed, to scope Phase II.

3.3.2.5 Feasibility Studies. Existing information on contaminants and physical parameters is not sufficient to evaluate remedial alternatives. In addition, the uncertainty in the nature and extent of contamination precludes evaluation of worker-protection measures that would be required during remediation. The evaluation of viable treatment technologies and remedial alternatives in the FS requires information about the physical and chemical properties of contaminated media, moisture availability, contaminant mobility, and the associated effect on offsite disposal considerations and transportation issues. More data are needed for complete identification of appropriate technologies in the FS and to facilitate the evaluation of short-term effectiveness, implementability, and cost. Summarized below are the unresolved FS-related issues that contributed to the decision to defer final risk-management decisions to the OU 3-14 RI/FS and ROD process:

- Soil contaminant types, distribution, concentration, depth, and volumes, requiring remediation are unknown. Process knowledge suggests that low- and high-level activity waste, mixed waste (including suspected listed hazardous constituents), and transuranic (TRU) waste may be present in the Tank Farm soil.

- Contaminant mobility must be determined for the OU 3-14 COPCs (to be determined after sampling).

- High-radiation fields from contaminated Tank Farm soil may require remote excavation and treatment.

- The fate of the tank residual contents (i.e., heels) of the 300,000-gal tanks is uncertain. Residual heels can be postulated to act as a major contaminant source at a distant future time. This uncertainty not only affects task prediction, but also affects the FS technology selection and evaluation. The magnitude of the source term from the heels is likely to be far greater than the magnitude of the source term from the contaminated soil.

- Transportation and disposal requirements are uncertain. The availability of appropriate waste disposal facilities on or off the INEEL site, especially for the potential volume of TRU waste soil, may be limited.

- The distribution coefficient (K_d) in modeling fate and transport of contaminants in both the Tank Farm soil and injection well sludge is unknown.

- Moisture flux in the Tank Farm soil must be determined.

- Risk from the aquifer within the INTEC security fence to future groundwater users must be determined.

Once the above uncertainties have been resolved, then potential remedial technologies can be investigated to determine their feasibility as a final remedial action.